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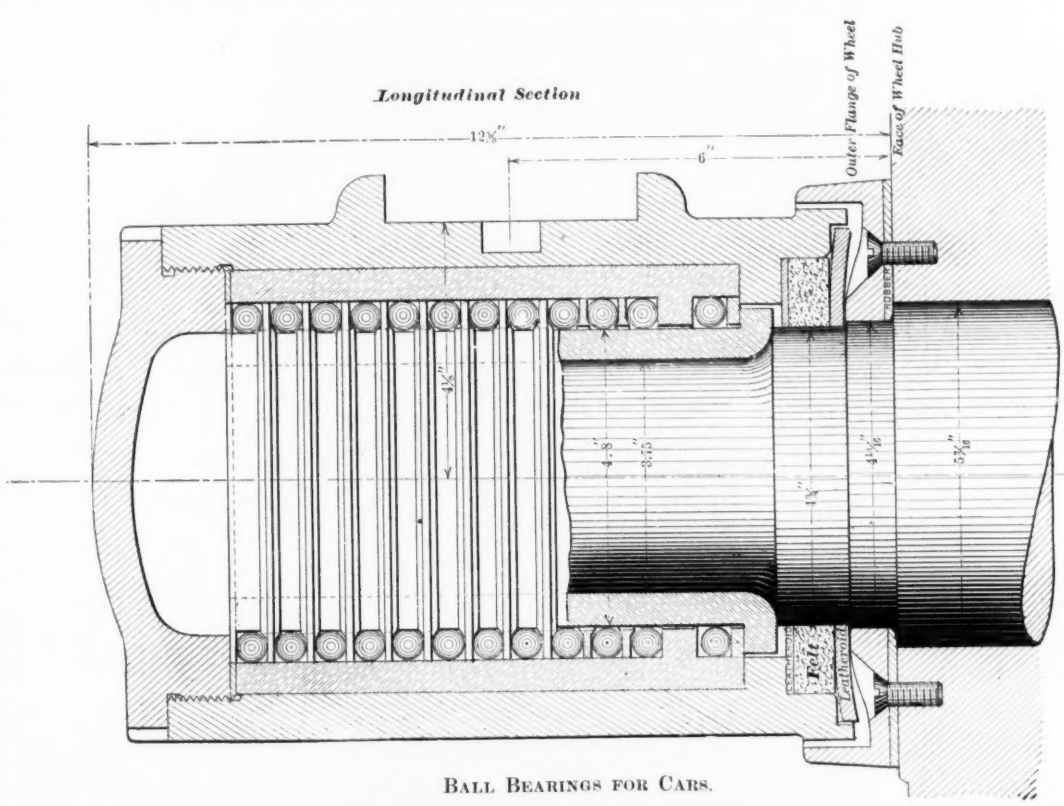
Ball Bearings for Cars.

The engraving on this page shows the construction of a bearing for railway and street car journals, designed by Mr. John J. Grant, and controlled by the Simonds Rolling Machine Company (Fitchburg, Mass.), of which he is manager. This bearing has been undergoing a practical test on the West End system of street railways (said to be the largest in the world), at Boston, for a year past, and, as a result of that test, equipment for twenty-five cars has recently been ordered, with the understanding that there is a probability that other orders will follow. Of course, for street cars, bearings much smaller and lighter than the one shown by the engraving are used, but the construction is essentially the same, our engraving having been made from a working drawing of a bearing made for trial on the Boston & Albany Railroad. In this test a registering dynamometer was used to indicate the force required to start a car when equipped with a common journal, and with the ball-bearing journal, and we are informed that 398 pounds pull was indicated with the former and only 90 pounds with the latter.

The construction of the journal will readily be understood from the engraving, which shows that the axle is provided with a hardened sleeve, and the box lined with a sleeve of the same kind, the balls rolling between these two surfaces, no grooves being provided for them to run in. Between the series of balls, however, there are loose rings of hardened steel, which serve to keep them in their proper positions, and, as shown, these rings are wider or thicker at their inner edges than at the outer edges, so that the balls are retained in place when the box is pulled off the journal, and it can be put back again without trouble.

The Boston street railway system spoken of uses both electricity and horses as motive power, and they find great advantage in the use of these bearings by the decreased difficulty in starting cars and in the tractive force required when in motion.

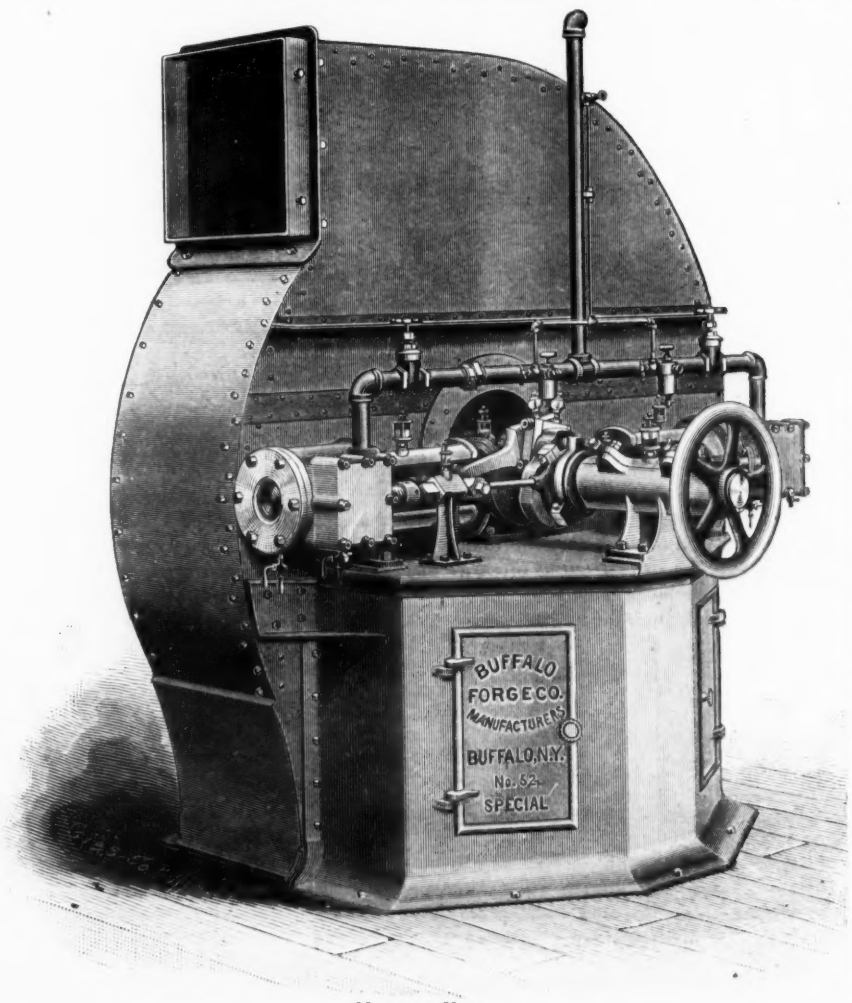


BALL BEARINGS FOR CARS.

Ventilating Fan for Ships.

On this and the succeeding page we give illustrations of a fan recently designed and built for the West India fruiting steamer "Neptune" by the Buffalo Forge Co., of Buffalo, N. Y.

This fan is located in the engine-room of the steamer, and its office is to draw out all foul air from the hold of the ship, and force it into the fire-room, in which a pressure of 2½ ounces is maintained. The fan is 7′ in diameter, 26″ wide, and is driven by a double engine with cylinders 6″x6″, either cylinder having ample capacity to drive the fan should it be required. By this fan the air in the ship is replaced every one and a half minutes. Our engraving on page 2 was made from a working drawing, and in this way will, of course, be little, if at all affected by the motion of the ship, as it is entirely self-contained. Special proportions have been adopted in this instance, as it is believed should usually be the case in marine work. It has been found that cargoes of fruit treated in this way during transit arrive at their destination in remarkably good shape, loss from decay being reduced to an insignificant amount.



MARINE FAN.

Mechanical Refrigeration and Ice-making.

THIRD PAPER.

BY EDGAR PENNEY.

I wish to correct an error of the types in my last article relating to the cost of ice. Five-ton plant should read $2.05 per ton, and that last named should read 100-ton, costing less than 90 cents per ton.

The plate system is perhaps the most interesting application of mechanical ice-making, inasmuch as by this system nature is so exactly counterfeited that experts cannot detect the difference between plate and natural ice, the resemblance in texture and general appearance being complete. It can be split with the same ease into cakes of convenient size and has similar cleavage lines.

Before describing the plate system I should explain that in the mold system of making ice a certain quantity of water is imprisoned in the can and the entire contents frozen. It is a well-known fact that during the freezing process certain organic matters, salts, carbonates and other impurities, are rejected or forced to the surface. This process of elimination continues until the water in the center of the mold becomes supersaturated and the lighter impurities float to the surface, the heavier being precipitated to the bottom.

The whole mass, of course, after exposure a sufficient length of time, is ultimately frozen solid, the result, especially with impure water, being a cake of ice with a central core, a top and bottom cone, and an intermediate feather (see Fig. 9, page 2).

To eliminate these unpleasant features of the mold system, it is necessary to use distilled water or adopt a slow freezing process, with a costly and extensive freezing surface, the result being that the best builders produce with distilled water a crystal ice, with a thin and scarcely perceptible feather, which, by the way, is caused by the imprisoned air cells at the point where the adjacent faces of the ice formation close against each other When freezing water in molds at low temperatures, and at a rapid rate, owing to the concentration of impurities at the center, you have an ocular demonstration of what is really contained in ordinary unpurified drinking water, which before freezing seemed pure and clear, owing to the impurities being distributed through the mass and held in solution. From this the reader will understand why distilling apparatus is used, and can readily see it would be of no advantage to use water power for the mold system where crystal ice is desired.

To offset or improve upon these not very serious defects of the mold system, numerous attempts have been made to appropriate nature's method of freezing ice in sheets, and secure conditions that approximate as closely as possible to that of nature by freezing only on the upper surface of the water, which allows the impurities to precipitate or settle to

the bottom of the apparatus, and thus secure clear, transparent ice, without resort to distillation.

The difficulties in the way of adopting an apparatus in which the sheet of ice is forced to form on the upper surface, similar to freezing on a pond, have not, from a commercial standpoint, been successful, but a satisfactory substitute is found in the plan shown in Fig. 10, page 3.

By this scheme the ice is formed on vertical walls or plates, the usual size of the cakes being 16 feet long, 8 feet wide and 10 to 16 inches thick, as desired.

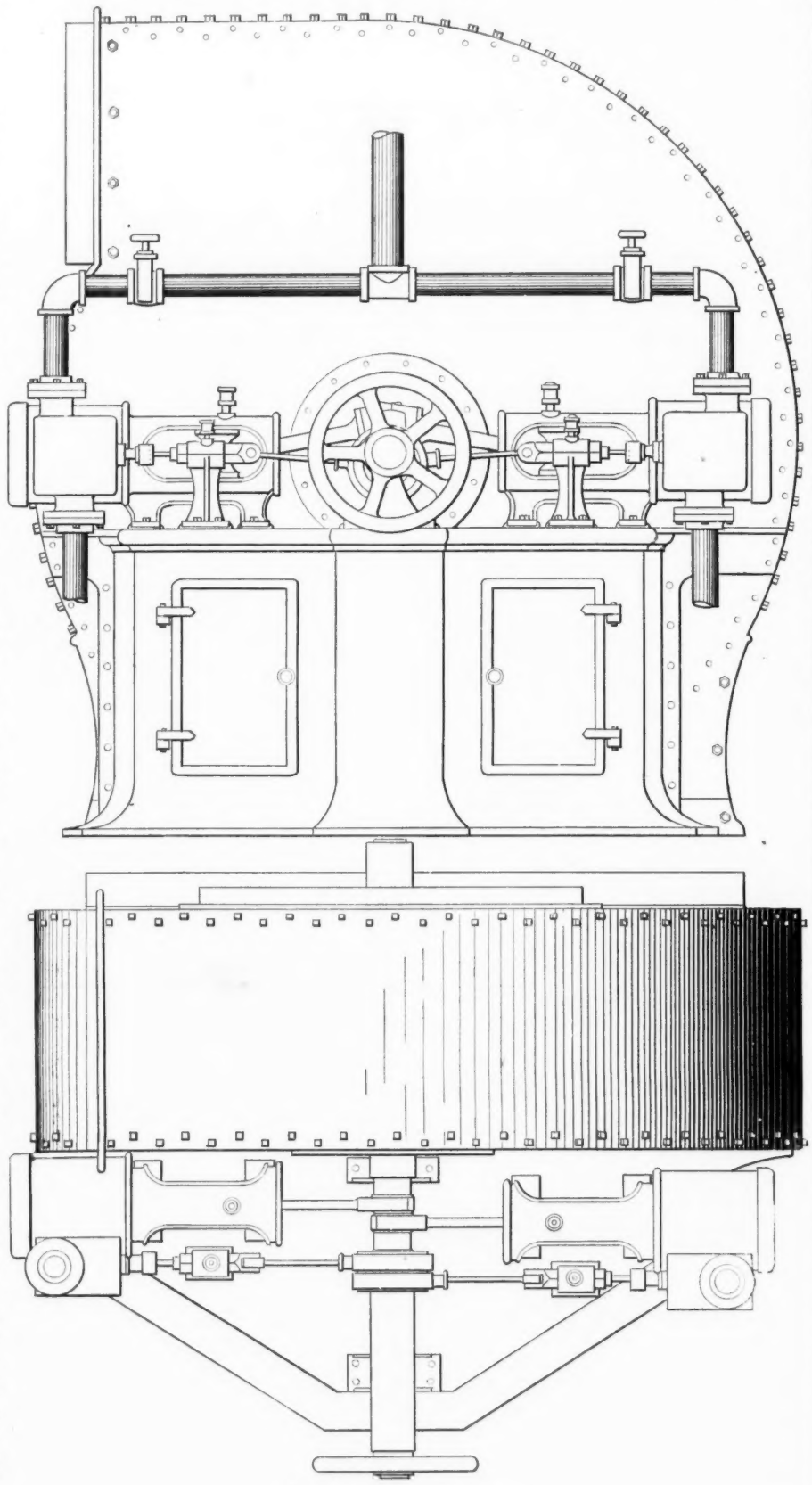
The apparatus employed (see Fig. 10) may be described as follows: To consist of a long wooden tank, divided into compartments by stout bulkheads, each compartment containing several cells or brine boxes, made of thin steel plates, the inner sides of the boxes being placed about three inches apart, each of which contains suitable ammonia evaporating coils. The outside surfaces of these cells are the freezing surfaces, and the distance allowed between the plates is regulated by the thickness of ice it is desired to make, and is generally about three inches greater than twice the thickness of the cakes, this being sufficient to prevent the ice from the opposing sides uniting.

The method of operating this apparatus is to fill the compartments with pure filtered water. Place the wooden covers on the section and open the ammonia expansion valves controlling the evaporating coils in each brine cell. The water soon begins to freeze, the ice building beginning upon the outside surfaces of the plates, the process continuing until a cake of required thickness is produced. The most interesting feature is that during the freezing process, which is quite slow (the time allowed for twelve-inch ice being eleven to twelve days), the impurities in the water are being continually rejected and thrown to the center of the space until the point of saturation is reached, when they begin to settle on the bottom of the tank, from whence, at the end of each freezing (or during the freezing with very bad water), the surcharged or impregnated contents are drawn off into the sewer. Air and gases freely rise to the surface and pass off. After each freezing the compartment is cleansed and recharged with fresh filtered water which has been previously cooled in a separate tank called the "fore cooler" or "settler."

And at this point some one may wish to know how we get the large cakes of ice, weighing three to five tons, out of the tanks. As will be seen by Fig. 10, a traveling hoist is provided for lifting the cakes, which have been previously loosened from the plate surfaces by withdrawing the brine from the freezing boxes and filling the cells with warm thawing water, the ammonia valves having been previously closed and evaporation stopped. When released, the cake of ice floats in the compartment, and a chain sling is readily passed around each end, as shown in the engraving. In the larger plate factories the hoist is operated by power, and the cutting up of the ice is done by steam gang saws, the cake being handled by traverse tables. As fast as the ice is drawn the tanks are refilled and the freezing continued. The product of the plate system is generally of marvelous brilliancy and transparency, there being no difficulty in reading a newspaper through a cake sixteen inches thick.

Fig. 11 shows the general arrangement of a plate ice factory, which differs from a can plant in some important details, and will be understood on inspection. As distilled water is not actually required on the plate plant, it is a favorite where water-power is obtainable, thus avoiding the use of steam for any purpose connected with the ice factory. For the above reasons, it is obvious that, where steam power is adopted in a plate plant, compound condensing engines, and all the valuable steam economies may be introduced, thus enabling ice to be produced at the lowest possible cost per ton.

Fig. 12 is a reproduction of a photograph of plate ice, the top of the tanks and freezing plates being seen in the foreground. A curious thing about the plate system is that water taken out of the muddy Mississippi River will turn out clear, transparent ice, the mud being precipitated to the bottom of the tank, where it may be drawn out as often as required, the water being changed. The photograph shown is of a cake of ice made from muddy river water. In practice I find many localities where the water is so free from organic matters, salts, etc., that it is not necessary to change the water in the tanks for the entire season.



Marine Fan.—See Page 1.

The plate ice is generally preferred, wherever introduced, to either the mold or natural ice, and sells, in most cases, at a higher price than either. The only drawback to its extended introduction and use is because of the greater first cost of the plate system, which for same tonnage capacity, owing to the large freezing surface required, is from 25 to 50 per cent. more than the can system.

Different methods of making sheet ice on the vertical wall system have been tried. In some cases brine alone that has been cooled in a separate tank is circulated in the cells; in others, the evaporating coils are operated upon the direct expansion system without brine. Attempts have also been made to freeze the ice directly on the evaporating coils themselves without the intervention of a plate. This is a very rapid system, but so far presents difficulties.

From the drawings, we trust the reader who has followed the text will have no difficulty in understanding the principles of operation and appreciating the good points of the plate system.

FIG 9

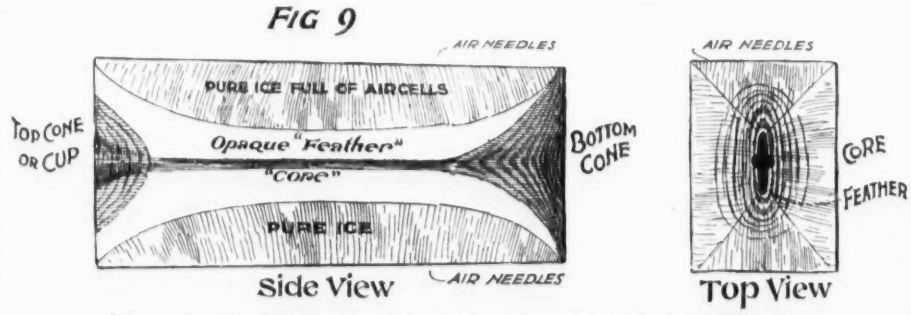


Fig. 9.—Appearance of Mold Ice from Very Impure Water.

A Boston Fire Boat.

"Engine 31" is the somewhat prosaic name of the most ambitious fire boat that has yet been brought into the service of the city of Boston, but this is in keeping with the character of the craft, which is presumed to represent much less of fancy than of utility. From the hour when she slid out of her cradle at the East Boston dock when first committed to the Fire Commissioners, she has been a subject of criticism or of favorable comment on account of the novelties of construction and the exacting character of the service for which she was designed. The system by which the propeller, as commonly located, is supplemented by one in the rudder, to multiply the power of turning, has been the subject of curious queries, and the formation of the hull and boilers has been adversely spoken of. These facts, together with the circumstance that the boat needed repairs, induced the commissioners to lay her off for improvement. After some delay at the Atlantic Works, East Boston, the boat was again placed at the service of the commissioners on Wednesday, and shortly before noon the members, together with a few representatives of city departments, started from India Wharf for a test at Long Island. Engineer Boyd, of the Atlantic Works, pointed out the changes that had been made, and the trial a little later demonstrated the improvements that had been wrought. The boat originally was equipped with a couple of water tubular boilers of the Cowles make. These have been displaced by two vertical boilers from the Atlantic Works, having a submerged smoke-box. The boilers are 6 feet 6 inches in diameter and 12 in height. They contain 478 2-inch tubes, and are made of the best material. Each boiler represents 200 horse-power. The working pressure is 120 pounds.

On reaching the pier at Long Island an exhibition was given of the playing power. The two large nozzles at the bow of the boat were at first simultaneously utilized, and a great volume of water was thrown, although in the course of the experiments only one engine and one pump was worked. Then the nozzles, one of which is a 3¼-inch and one a 4-inch, were used in succession, and sent a stream from 300 to 400 feet. The members were apparently well satisfied with the test made, particularly as it showed only half the potentiality in the boat. It is intimated that the pumps have a capacity of throwing 6,500 gallons a minute. The return trip gave illustration of the speed and turning power of the boat. From the commissioners it is learned that the cost of the changes has been $7,000, but as the old boilers have been sold for $1,000, the net outlay will be but $6,000. No other changes have been made in the boat.

A new and more tasteful vesture of paint will be applied within and without, and the Greek Cross which has been made so typical an emblem of Boston's fire service will be conspicuous on the smoke-stack.—*Boston Morning Journal.*

Some shrewd inventor might find scope for his genius in improvements on street-cleaning methods. Compared with European cities, the streets of American cities are filthy. Probably the most important invention would be one that should divorce street cleaning from politics. The appropriations are not large enough for the usual division. After this invention was in complete working order, attention might be turned to better methods for collecting and handling the dirt. Present methods are rather crude, but there is the greatest necessity for the first invention named.

Capt. Watt's Quadruple Expansion Engine.

Capt. Archibald Watt, owner of the trim schooner yacht Osprey, set to work a year and a half ago to build a steam launch that he might swing to his davits. He is a practical machinist of an inventive turn, with a fondness for doing his own work when he wants a particularly nice job, and the result of his experiments is a new engine, which, if it accomplishes all he claims for it, will create a new era in steam navigation.

It is the first quadruple expansion engine ever built, and, while it has four cylinders, is so compact that it can be covered by a bushel tub. The cylinders stand one above the other and are respectively about 4, 5, 6 and 8 inches in diameter. The piston rods of the lower cylinders are connected with those of the upper, and this arrangement, it is claimed, results in a cumulative application of power. The engine is adapted for running by either steam or gas, but the best results are attainable with gas.

The gas to be used is generated by boiling oil in a kind of retort. The boiler is as compact in its way as the engine. It is about the size of a four-gallon ice cooler, and, with the fire-box and engine, weighs only 380 pounds. The generation of the gas, Capt. Watt says, embodies a discovery. Seven oils are mixed together. One of them is kerosene, and while the Captain will not tell what the others are, he says they are cheaper than kerosene. The boiling of this combination generates, he says, a gas of remarkable power—so remarkable, in fact, that the engine, which was built to make 380 revolutions, has made by its use over 500, and can, he thinks, be run with comparative ease up to 800 or 900 revolutions per minute. The devices for economizing power are on a par with those for saving space.

The gas, after it has passed through the engine, being too hot for use as fuel, is drawn off into a pipe running alongside the keel of the boat, where it is condensed by contact with the water in which the boat floats. The resulting oil is returned to the fire-box and consumed as fuel. The supply of oil is carried in a twelve-gallon tank at the bow of the boat, and means are provided for feeding the fire-box, which is under the boiler at the stern of the boat, direct from this until the engine is started. After the engine is started the supply from this source is cut off, and the oil from the condensing pipe is used alone for fuel. This is smokeless, so that, except for a few minutes before the start, the engine is run without smoke.

The launch is only 16 feet 4 inches long. She is fitted with twin screws of two blades each, and the blades have much more pitch than usual. It is, of course, impossible to drive such a small boat at any very high rate of speed, but, as Capt. Watt says he can develop ten to twelve horse-power with his engine, he thinks he can make her go over six, and possibly ten miles per hour, which will be a wonderful performance. The launch, which is to be called the Hum, will be launched next Saturday afternoon on the Harlem River at One Hundred and Forty fifth street, and will then be tried in the presence of a number of invited guests, who will witness her performance from the deck of the Osprey.

Capt. Watt says he can build an engine like this on any scale, and if it realizes his expectations it will make possible a much higher rate of speed than has yet been developed by any steam vessel.—*The New York Times.*

[Of course this is not the first quadruple expansion engine built, and equally of course there is nothing in the "cumulative application of power," but there are evidently some novel, and probably good points, about the engine.]

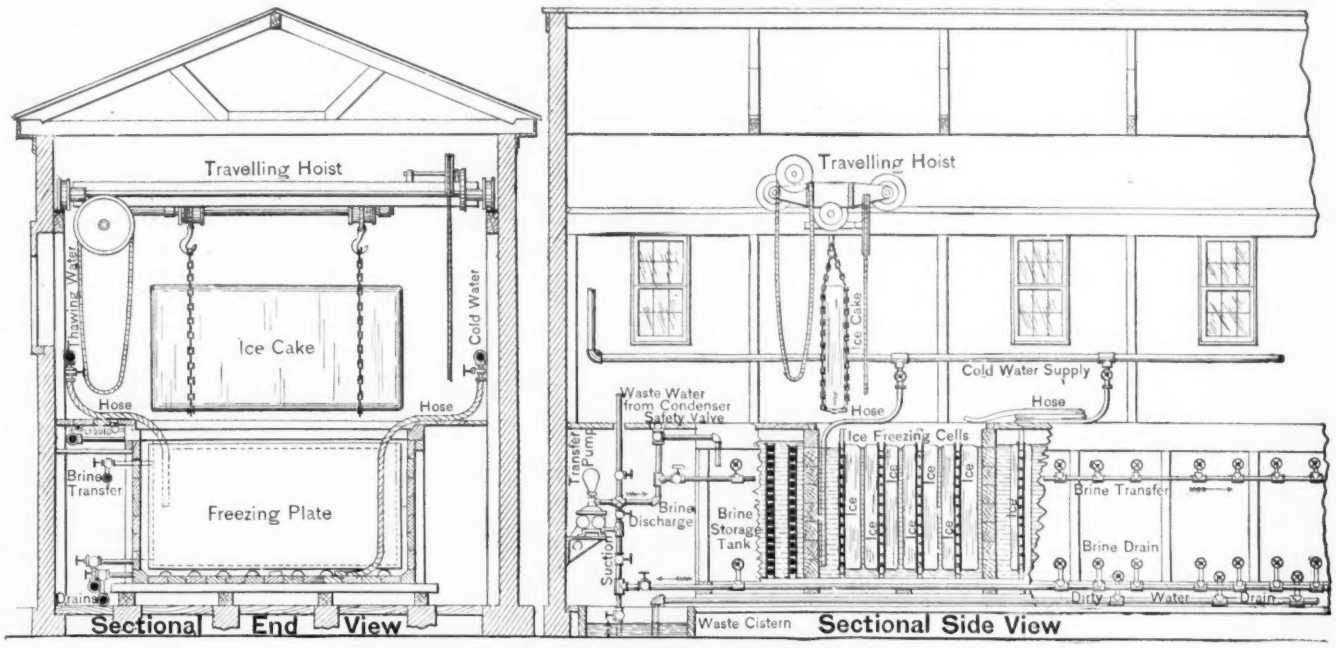


FIG. 10.—VERTICAL PLATE OR WALL SYSTEM OF MAKING ICE.

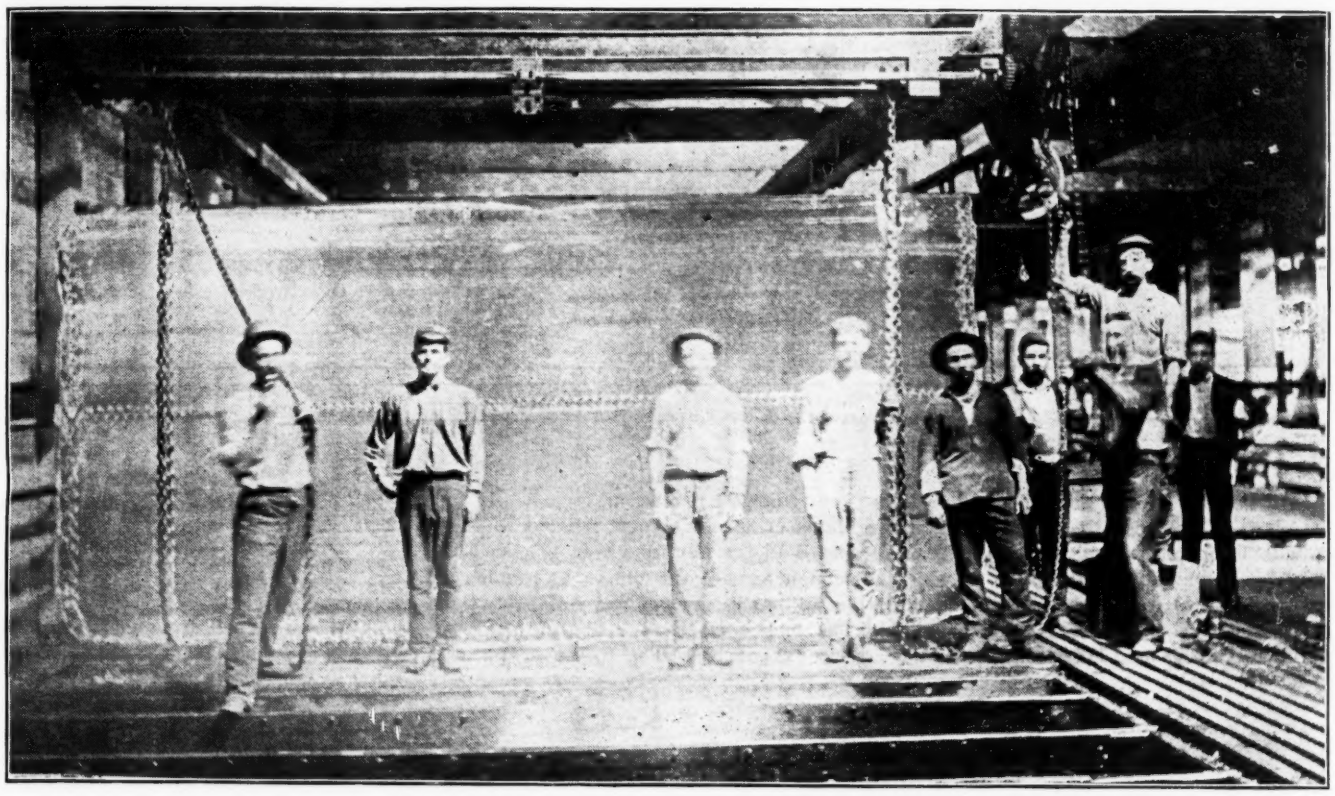


FIG. 12.—PHOTOGRAPHIC REPRODUCTION OF PLATE ICE.

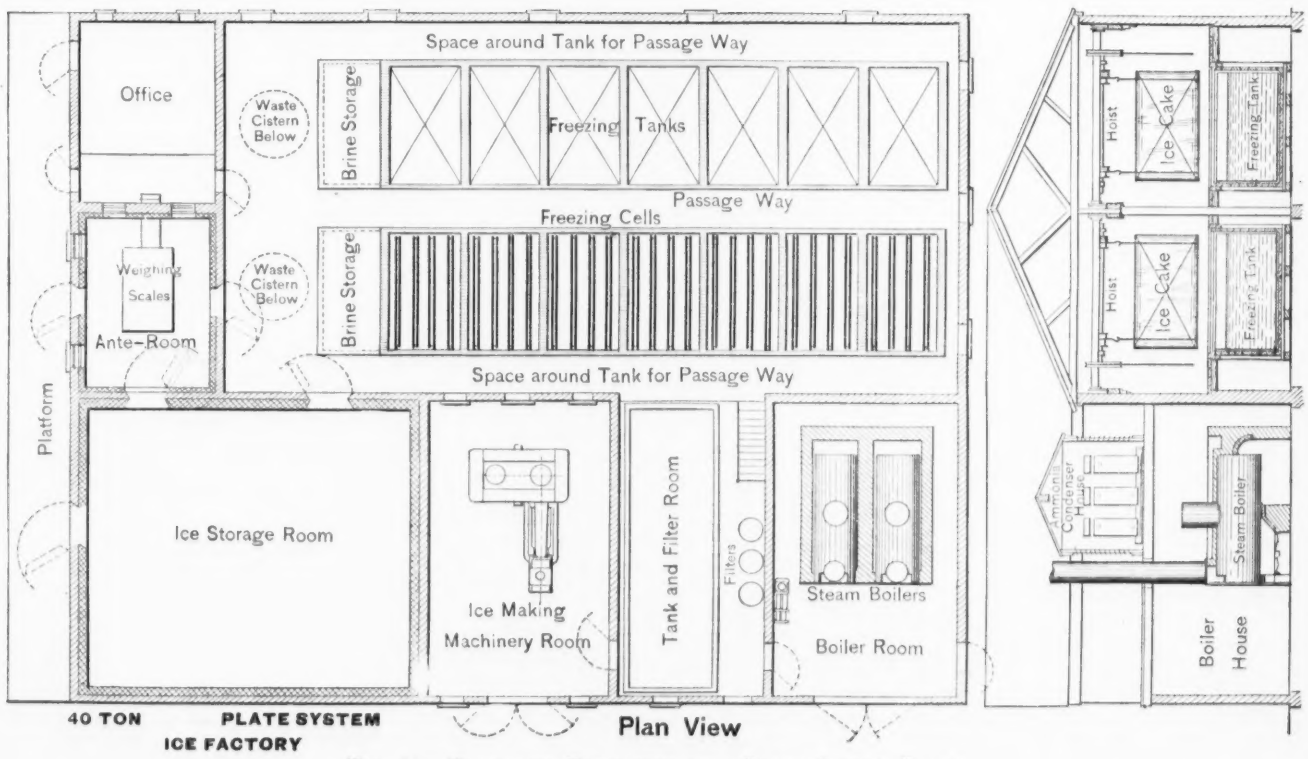


FIG. 11.—PLAN AND ELEVATION OF A PLATE SYSTEM PLANT.

Solder for Aluminum.

In our issue of July 24 we published some directions for working aluminum which were had inquiries from mechanics regarding a suitable solder and method of using it. We addressed a letter of inquiry to the company, and in reply received the following statement:

* * * * The directions issued by us in regard to the working of aluminum, in which it was stated that we could furnish a special solder suited to aluminum, were issued, under a misapprehension, on the part of a young gentleman who, at that time, was in our employ. They were suppressed as soon as the facts were thoroughly known to the managers of the company.

We have not as yet succeeded in procuring a solder that will work satisfactorily on aluminum, and we do not believe that such a solder exists. We are told that the French government has had a standing reward offered for many years for the production of a satisfactory solder for aluminum, and that as yet no claimants have appeared for the reward.

SCOVILL MFG. CO.
M. L. SPERRY, Secy.

To the Pittsburgh Reduction Co., which manufactures aluminum, we also addressed an inquiry, and in reply received the following:

We cannot give you any information regarding any reliable solder for aluminum. All solders with which we have experimented so far have proved practical failures. The best solder heretofore found has been pure zinc used with Venetian turpentine. Experiments and investigations are constantly going on with a view to finding a true solder for aluminum, and when it is found we will be glad to let you know.

THE PITTSBURGH REDUCTION CO.
ALFRED E. HUNT, President.

It will thus be seen that those of our readers who wish to solder aluminum must first procure their solder, and when they have procured it they will probably find a lively demand for it.

Indicator Diagrams from Machine Tools.

BY PROF. L. P. BRECKENRIDGE.

Some time ago the writer made a series of experiments with a drill press and twist drills in order to determine what pressures came on the points of the drills, or on the drill press table while drilling. The method of this determination gave such satisfactory results that it has later been applied to the planer, and the results obtained are given in the present article. The primary object sought in these experiments was the determination of the pressure exerted against the planer tool point while cutting. If this pressure is determined it is evident that the power required to plane the metal under consideration is easily determined when we know the cutting speed in feet per minute.

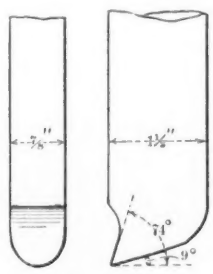


Fig. 1.

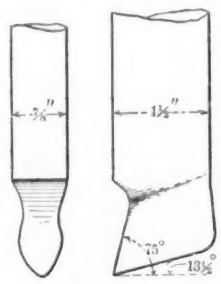


Fig. 2.

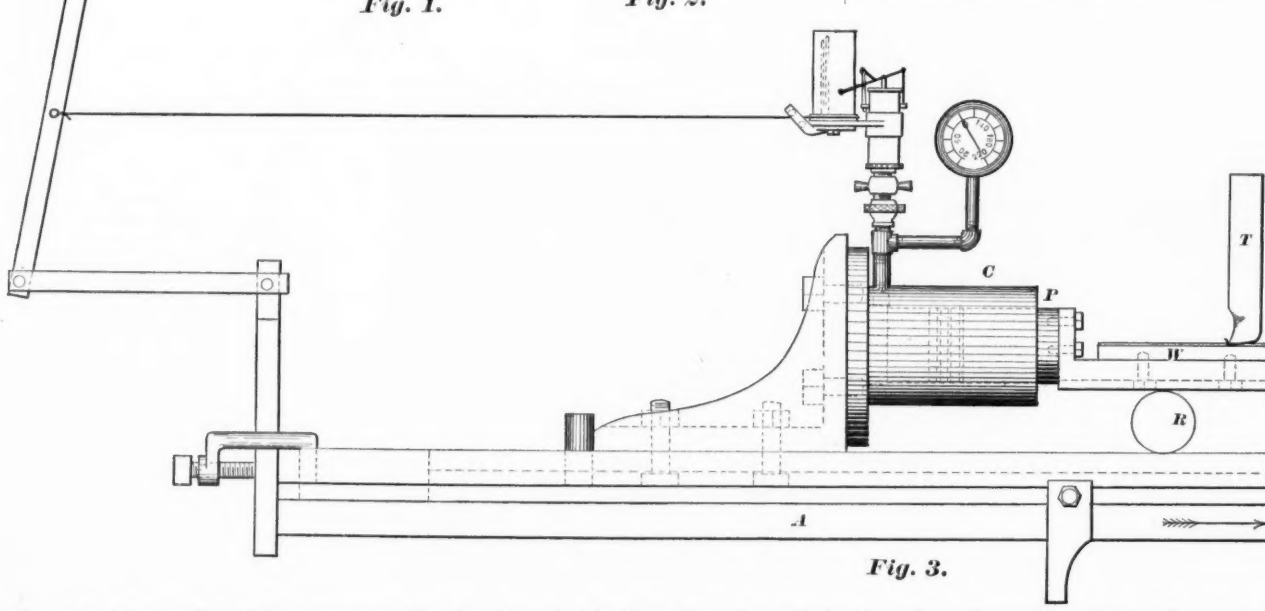


Fig. 3.

DESCRIPTION OF APPARATUS.

In Fig. 3 is shown a side view of the apparatus as it appears attached to the planer table *A A* by means of the usual angle plate. It consists of the cylinder *C* carefully bored to receive the plunger *P*, and tapped above for one-half inch connections to the indicator and pressure gauge as shown. The area of the cross-section of the plunger at right angles to its axis is exactly 10 square inches, or about 3.57 inches in diameter. The plunger, which is solid cast-iron, is 6 ins. long, and while in use extends out of the cylinder about 1 inch; the end of the plunger inside the cylinder has 3 grooves turned in it $\frac{3}{32}$ inch wide and deep, and $\frac{1}{4}$ inch apart.

Fastened to the head of the plunger is the cast-iron angle piece *B*, which is 4 inches wide, and rests on two wrought-iron rolls *R*; the bearing of this piece *B* on the rolls is 1 inch at each edge, the middle of the under side being planed out so that the heads of the bolts which fasten the piece *W*, which is to be planed, to the piece *B*, will not strike the rolls. The piece *W* is tapped to receive the cap screws used in fastening it to *B*.

The pieces planed were cast 3 inches wide, 12 inches long and 1 inch thick, the thickness being chosen so that the top surface came $\frac{5}{32}$ inch above the axis of the plunger. It was thought that the most accurate results would be obtained when the tool was cutting along a line coincident with the axis of the plunger, but there was no noticeable difference in the pressures recorded for a space of $1\frac{1}{2}$ inch along the middle of the pieces experimented upon.

The tool *T* is shown in about the middle of a cut, and it must be regarded as stationary, the tool-box and its connections, as well as the bed of the planer, not being shown. The reducing motion for the indicator is shown at the left. *F* is a fixed point, the swinging lever and connecting link being moved back and forward by the piece clamped to the end of the planer.

A space of about $2\frac{1}{2}$ inches exists between the end of the plunger and the bottom of the cylinder. Into this space cylinder oil was turned, the plunger being pulled out about 2 inches during this time. When sufficient oil has been turned in, the plunger is slowly pushed into the cylinder, the gauge connection loosened in order that all the air may be driven out, the indicator screwed on, and when oil appears at the several loose places everything is made tight, and the apparatus is ready for use. The cutting speed of the planer was not as fast as many planers run. The cuts taken were measured by calculations from the number of threads per inch on the cross and vertical feed rods. They varied all the way from light to cuts heavy enough to stop the planer by running off the $2\frac{1}{2}$-inch belt, which was reasonably tight. The tools used were made of tool steel, size $\frac{7}{8}$x$1\frac{1}{2}$ inches. The tool used for cast-iron is shown in Fig. 1, while Fig. 2 shows the one used with wrought-iron.

The following tables give complete the results of the experiments, the numbers in column *f* being the solution to the problem, *i. e.*, "total pressure against the tool in pounds."

Some few cards are given as samples of the work. The number of the cards corresponds to the "No. of Experiment," given in the first column of the tables. The cards, from Nos. 1 to 45 inclusive, have the "admission end" (if I may be allowed the use of the term in this connection) at the left-hand end, the other cards at the right-hand end.

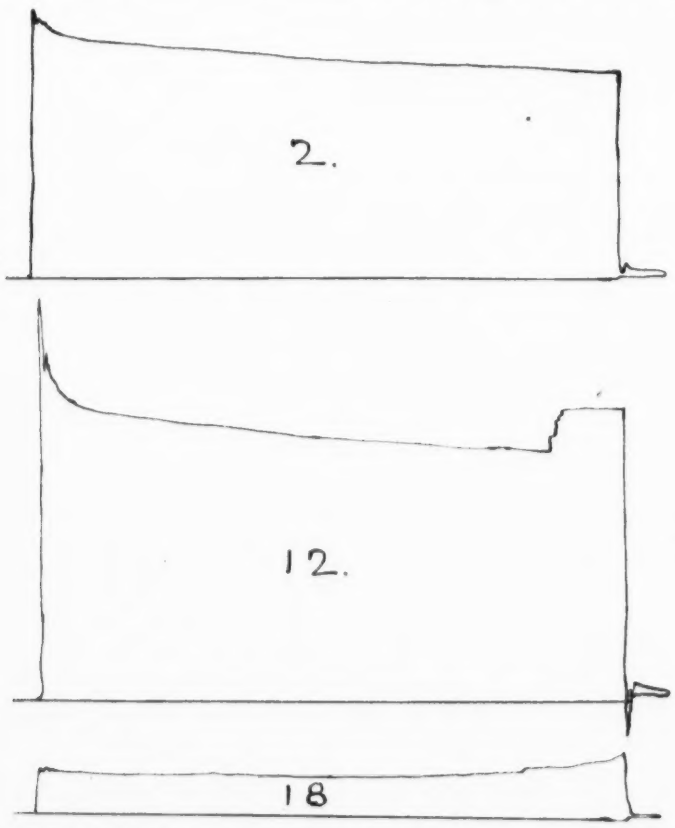
The gauge was used in order to know what pressures were likely to occur on the indicator piston, and to thus determine the proper spring. It was read during each experiment, but the reading had to be taken so quickly that it does not always appear consistent.

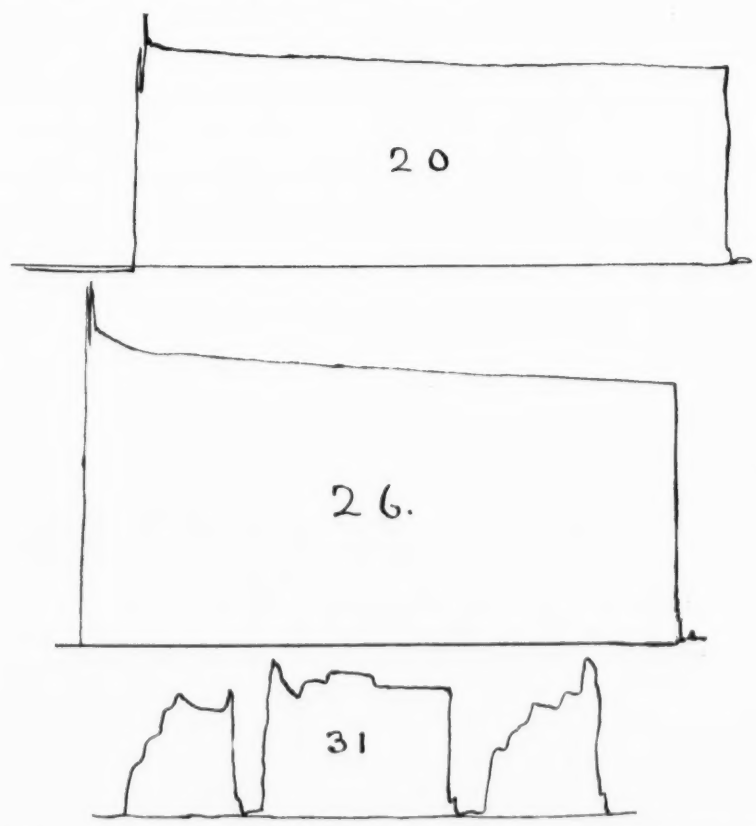
Both indicator springs and gauge were tested under water pressure, and were both correct within one pound at all points of comparison.

The experiments were made at the works of the Bethlehem Foundry and Machine Company, South Bethlehem, Pa., to whom the writer desires to express his thanks for the privileges granted and courtesies shown at the time.

Measurements taken from planer:

1. Maker, G. E. Brettrell, Rochester, N. Y.
2. Length of bed, 9 feet 9 inches.
3. Length of table, 8 feet 2 inches.
4. Width of table, 2 feet 3 inches.
5. Angle of shears, 90°.
6. Distance between uprights, 2 feet $7\frac{1}{2}$ ins.
7. Height will plane, 2 feet 5 inches.
8. Diameter of cutting pulley on planer, 24 inches x 2.5 inches face.
9. Diameter of returning pulley on planer, 15 inches x 2.6 inches face.
10. Tight and loose pulleys on counter, 12 inches diameter x 5 inches face.
11. Pulley for cutting on countershaft, 15 inches diameter x $5\frac{1}{2}$ inches face.
12. Pulley for returning on countershaft, 9 inches diameter x $5\frac{1}{2}$ inches face.
13. R. P. M. of countershaft, 205.
14. R. P. M. of cutting pulley on planer, 127.
15. R. P. M. of returning pulley on planer, 122.
16. Threads per inch on cross feed, 4.
17. Threads per inch on down feed 6.
18. Width of belt from counter to planer, $2\frac{1}{4}$ inches.
19. Width of belt from main to counter, 4 inches.





EXPERIMENTS OF MAY 6, 1889, A. M.

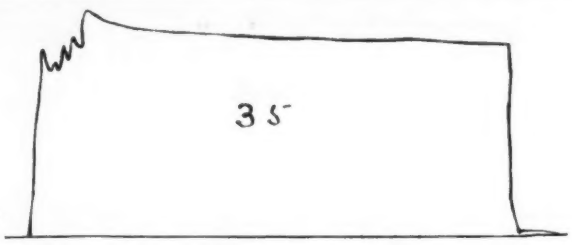
Material planed, cast-iron. Exps. 1 to 15.

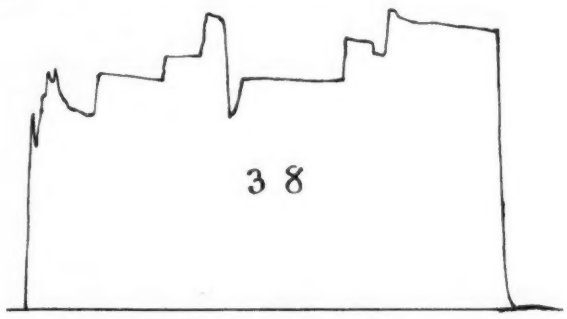
Width of cut = rate of feed = .0625 inch = $\frac{1}{16}$ inch.

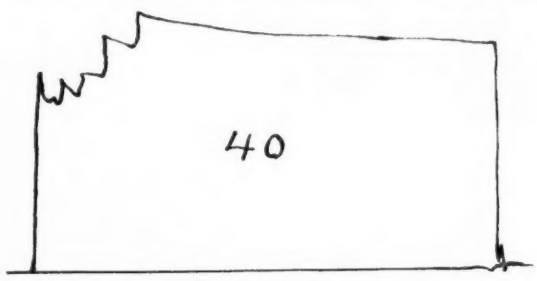
Velocity of tool while cutting, 10.9 ft. per min.

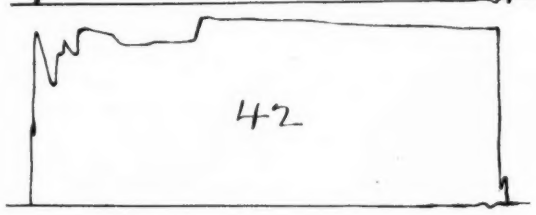
Spring used in indicator 30. Length of diagrams, 3.14 inch.

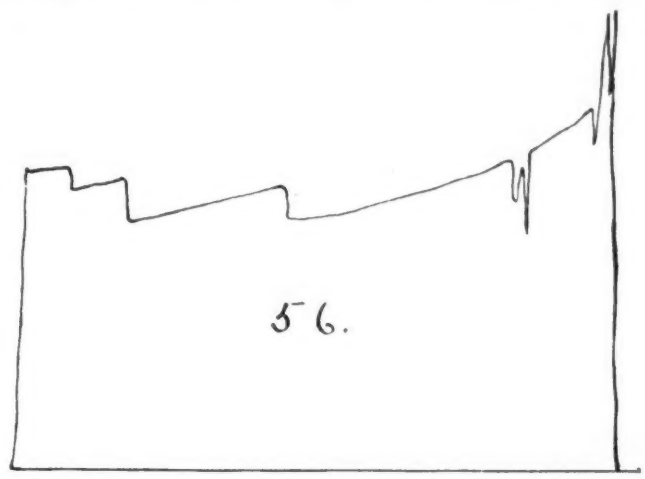
Tool used shown by Fig. 1.

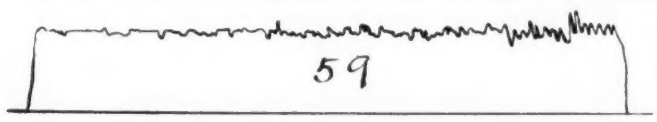


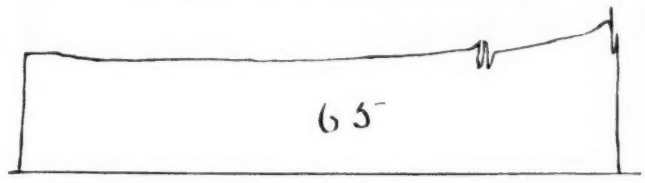


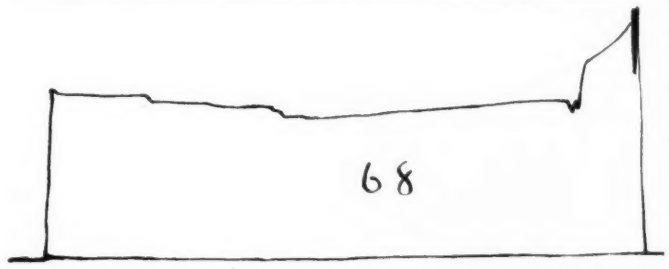


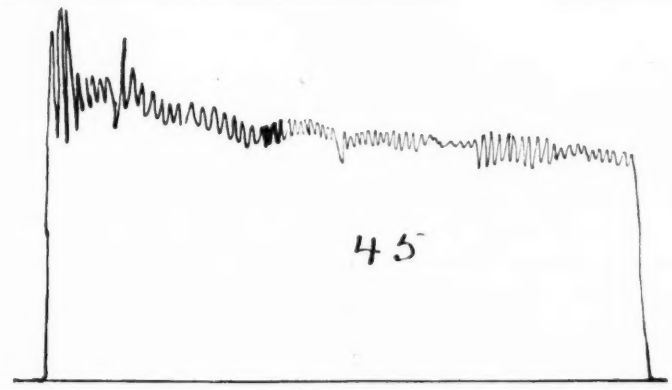












Springs used in indicators, (44-49) 40, (50-74) 80

Length of diagram, 3.18 inches

Tool used shown in Fig. 1.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*
44	0.017	52	3.86	48.6	486	5152	0.156	0.083
45	0.017	55	4.30	54.2	542	5745	0.174	0.083
46	0.033	75	5.46	68.8	688	7293	0.221	0.083
47	0.033	75	5.81	73.2	732	7759	0.235	0.083
48	0.017	52	3.94	49.6	496	5257	0.159	0.083
49	0.050	90	No Card	.....	850*	9000	0.273	0.083
50	0.017	65	2.55	64.3	643	6816	0.206	0.126
51	0.017	70	2.52	63.5	635	6731	0.204	0.126
52	0.033	110	3.58	90.2	902	9561	0.290	0.117
53	0.033	70	2.38	60.0	600	6360	0.193	0.117
54	0.050	120	4.58	115.4	1154	12190	0.370	0.117
55	0.050	130	No Card	...	1250*	13250	0.400	0.117
56†	0.050	125	478	120.4	1204	12720	0.385	0.117
57	0.050	125	No Card	.....	1204*	12720	0.385	0.117
58	.....	..	3.46	87.2	872	9243	0.280	0.117
59‡	0.017	40	1.36	34.2	342	3625	0.109	0.055
60	0.017	39	1.36	34.2	342	3625	0.109	0.055
61	0.017	40	1.27	32.0	320	3392	0.103	0.055
62	0.017	40	1.34	33.7	337	3572	0.108	0.055
63	0.017	32	1.00	25.2	252	2671	0.081	0.055
64	0.033	55	1.94	48.9	489	5183	0.157	0.055
65	0.033	57	2.02	50.9	509	5395	0.163	0.055
66	0.050	70	2.55	64.2	642	6805	0.206	0.055
67	0.050	70	2.56	64.5	645	6837	0.207	0.055
68	0.050	70	2.61	65.7	657	6964	0.211	0.055
69	0.050	70	2.35	59.2	592	6275	0.190	0.055
70	0.050	73	2.45	61.7	617	6540	0.198	0.055
71	0.017	..	2.45	61.7	617	6540	0.198	0.165
72	0.067	90	3.36	84.6	846	8967	0.271	0.055
73	0.083	105	3.79	95.5	955	10123	0.306	0.055
74	0.083	100	3.60	90.7	907	9614	0.291	0.055

* Pressure estimated.
† Spring of work or tool, see card.
‡ Blow holes, see card.

Some Experiences with Crane Chains.*

At the Washington meeting there was some discussion on the subject of chains used for cranes, in which the opinion was expressed by the writer that the failure of such chains was almost invariably due to the use of bad material in the construction of the chain, and not to any mysterious deterioration of the iron from use. This, of course, has nothing to do with the failure of chains manifestly too light for the use. This opinion was based on a considerable personal experience with wrought-iron in construction, beginning with tests of material for the St. Louis Bridge.

During the past year I have had a little experience bearing directly on this subject. We have, in the foundry department of William Tod & Co., a power crane, on which we have occasionally to lift twenty-five tons. The crane was built about fifteen years ago, and equipped with a chain made of 1¼-inch iron, running over sheaves sixteen inches diameter. The winding drum is twenty inches diameter, the drum and sheaves all being grooved deeply enough to prevent the links touching the bottom of the grooves. The chain had become considerably worn in the bends of the links, and had broken, perhaps twice, but not at the worn places. We ordered a new chain, taking some pains to try to find reliable chain makers, and to impress on them the necessity for the best material and work. Within two weeks after putting on the new chain it broke under a load not exceeding eighteen tons on the crane, the fracture being short at near the middle of the straight sides of the link. The chain manufacturers then made another one, but before it arrived the chain in use failed again, under a crane load of not more than twelve tons.

The link first broken was sent away, but in the accompanying photograph [reproduced on page 6]. No. 210 is one-half of the link last broken. No. 211 is another link from the same chain, cut out and broken to examine the quality of the iron, and No. 212 is a link from the chain last made and now in use. This link was cut open hot at one end to remove it from the chain. It was then nicked on the inside of the bend at the other end, and mashed down under a hammer to its present shape. The link first broken presented a fracture similar in appearance to that of Fig. 210.

Now, here was a chain which failed twice in the first month of its use, while only two, or possibly three links had been broken from the old chain in fifteen years' continuous use. The crystallization theory will hardly account for this, although the fractures of the broken links present the same appearance, and are just such as are usually attributed to that popular delusion. The photograph tells the whole story. The iron is cold-short, and totally unfit for the use.

In characterizing the crystallization theory as a delusion I am perfectly aware that iron is often subjected to such severe flexure or vibration, continuously, as to destroy its cohesion and render it weak and brittle; but while a crane chain in constant use is treated rather rudely, it does not receive anything like sufficient punishment to produce such an effect. The fracture would also be quite different in appearance, bright, it is true, but presenting a surface of rounded granules, rather than sharp crystals.

This condition is probably caused by a gradual breaking up of the fibers, without any of the supposed rearrangement as crystals, and is doubtless very weak as well as brittle; while cold-short iron is usually very strong against a direct pull.

A phosphorus determination from borings from Fig. 210 showed .00125, or, as it is usually expressed, .125 of one per cent., which is sufficient to account for the character of the iron.

The last chain in the present case has not failed in any way up to the present time, and if it is all of as good material as the link mashed, No. 212, it will probably only give out when worn to an insufficient section at some point.

The question of principal interest to most of us is, how to obtain good chains. I know of but one certain way, and that involves some trouble and expense. I refer to the inspection of the material before manufacture, and of the workmanship after, by a competent engineer.

Giving a piece of chain a mild pull in a testing machine enables the manufacturer to certify that it has been "tested," and may occasionally open a particularly bad weld, but can serve no other useful purpose.

The ability to stand bending cold is the most important quality of chain material, because that is the principal, if not the only cause of chain failure. In fact, for this purpose the cold bend test will usually show all the engineer wants to know of the material.

Perhaps, as the millennium approaches, a certificate of inspection which shall mean something will accompany all chains. At present, however, we shall have to conduct the inspection at our own expense, or take what we can get. There are, undoubtedly, some manufacturers who would make chain to suit our specifications, if not hampered in

* A paper read at the Cincinnati meeting of American Society of Mechanical Engineers, May, 1890.

EXPERIMENTS OF MAY 7TH, 1889, P. M.

Material planed, wrought iron. Exps. 30 to 43.

Width of cut = rate of feed = .05 inch = $\frac{1}{20}$ inch.

Velocity of tool while cutting, 10.66 feet per minute.

Spring used in indicator, 40.

Length of cards, 2.52 inches.

Tool used shown in Fig. 2.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
No. of experiment.	Depth of cut in inches.	Average pressure by gauge, lbs.	Area of diagram in square inches.	M. E. P. by diagram, lbs.	Total pressure against the tool, pounds.	Foot-pounds of work per min. to plane the iron.	H. P. required to plane the iron.
1	0.032	40	3.84	36.7	367	4000	0.121
2	0.032	37	3.73	35.6	356	3880	0 117
3	0.032	41	4.15	39.6	396	4316	0 130
4	0.063	60	5.85	55.9	559	6093	0.184
5	0.063	58	5.54	52.9	529	5766	0.174
6	0.063	53	4.67	44.6	446	4861	0.147
7	0 063	50	5.00	47.8	478	5210	0.157
8	0.063	48	4.48	42.8	428	4665	0.141
9	0.063	45	4.37	41.7	417	4545	0.137
10	0.063	55	5.55	53 0	530	5777	0 175
11	0 063	48	4 56	43.5	435	4741	0.143
12*	0.063	46	4.57	43.6	436	4752	0.144
13	0.063	47	4.48	42.8	428	4665	0.141
14	0.063	50	4.93	47.1	471	5133	0.155
15	0.063	30	3.56	34.0	340	3706	0.112

* Chilled spot in casting at end.

EXPERIMENTS, MAY 6, 1889, P. M.

Material, cast-iron. Exps. 16 to 29.

Width of cut = rate of feed = $\frac{17}{256}$ inch = 0.066 inch.

Velocity of tool while cutting = 10.32 feet per minute.

Spring used in indicators, 30. Length diagrams, 3.17 inches.

Tool used shown in Fig. 1.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
16*	0.017	7	0.64	6.05	60.5	623.1	0.019
17*	0.017	7	0.72	6.81	68.1	701.4	0.021
18*	0.017	8	0 75	7.09	70.9	730.3	0 022
19	0.033	37	3.52	33.3	333	3430	0.104
20	0.033	37	3.45	32.6	326	3358	0.102
21	0 033	32	2.96	28.0	280	2884	0.087
22	0.033	30	2.95	27.9	279	2874	0.087
23*	0.050	40	3.78	35.7	357	3677	0.111
24	0.017	17	1.66	15.7	157	1617	0.049
25	0.017	17	1.76	16.6	166	1710	0.052
26	0.067	50	4.63	43.8	438	4511	0.137
27	0.067	51	4.83	45.7	457	4707	0.142
28	0.067	52	5.34	50.5	505	5201	0.158
29	0.067	35-50	4 78	45.2	452	4656	0.141

* Doubtful if this cut was full depth.

EXPERIMENTS OF MAY 8TH, 1889, A. M. AND P. M.

Material, planed cast-iron. Exps. 44 to 74.

Width of cut = rate of feed (see column *i*).

Velocity of tool while cutting = 10.6 feet per minute.

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*
No. of experiment.	Depth of cut in inches.	Average pressure by gauge lbs.	Area of diagram in square inches.	M. E. P. by diagram, lbs.	Total pressure against the tool in pounds.	Foot pounds of work per min. to plane the iron.	H. P. required to plane the iron.
30	0.033	35	1.69	26.8	268	2841	0.086
31*	0.033	30	1.32	21.0	210	2226	0.067
32	0.050	25	1.57	24.9	249	2639	0.079
33*	0.050	20	1.13	17.8	178	1887	0.057
34	0.067	30	1.85	29.4	294	3116	0.094
35	0.117	43	2.73	43.4	434	4600	0.139
36	0.117	40	2.17	34.5	345	3657	0.110
37†	0.067	38	2.04	32.4	324	3434	0.104
38‡	0.117	60	3.36	53.4	534	5660	0.171
39§	0.117	60	....	....	...	....	.....
40‖	0.117	55	2.92	46.4	464	4918	0.148
			3 00	47.7	477	5056	0.153
41**	0.117	55	2.90	46.1	461	4887	0.147
42**	0.117	40	2.37	37.6	376	3986	0.120
43**	0.117	45	2.46	39.1	391	4145	0.125

* Planed across two holes, *a* and *b*. See card No. 31.
† Ground tool here.
‡ Tool touched edge of one hole.
§ Diagram spoiled.
‖ Without oil.
** Used oil.

price; and there may be some who make reliable work of their own free will; but the search for them is not certain to be short or inexpensive. Our own experience in this direction has not been reassuring. At any rate, we are not likely to get good chain, or good anything else, unless we ask for it. And as long as we are willing to believe that a brittle link was made so by some mysterious influence or condition of its use, so long will chains be made of cheap cold-short iron.

In discussing this paper Mr. Gus. C. Henning spoke as follows:

The experience given in the paper under consideration is unfortunately one of too common experience, and the photographs shown, and explanation given, leave no doubt that the fault of the chain was solely cold-shortness—high phosphorus. This per cent. of phosphorus is a very common one in some of the best tee made in Pittsburgh and elsewhere, given in the tension test as much as from 51,000 to 56,000 pounds tenacity, 25 to 30 per cent. elongation in 8 inches, and from 35 to 60 per cent. reduction accordingly, so the material is tested in bars of from $\frac{3}{4}$ inch to $2\frac{5}{8}$ inch diameter, all these factors changing in proportion to diameter or work done during rolling. This same iron, however, although welding admirably when using a bright coke or gas fire, will give considerable trouble with coal fire.

Furthermore, although this material when it comes from the rolls is thoroughly fibrous, and shows no crystallization whatever, is precisely of that quality which, when subjected to heating and quenching, will become granular or crystalline, and become valueless, especially for chains, every link of which is heated, reheated, welded and hammered.

I wish to add my opinion to that of the author, that there is no such thing as gradual crystallization of iron, when properly used, although constantly in vibration.

The iron shown and described, however, can be injured by shock or other percussion, and this can occur in crane chains, which are generally very roughly handled. They often stick under heavy castings or forgings, and then a sledge is used to loosen them; this sledging can in such iron, produce granulation, and ultimate failure of the chains.

Inasmuch as such is of common occurrence enough care cannot be exercised in selection of a low P and low S iron, nor the process of manufacture of chains be too carefully watched at all times. With such iron the workmanship is all important, and even with the greatest care, many defects may exist; and, inasmuch as smiths are prone to cold finishing to use water on hot material, and to straighten material cold by sledging, an iron should be selected which cannot be injured by such treatment. This can be readily done by intelligent inspection, and there would be no difficulty in obtaining a material which will give entire satisfaction, being free from accidental liability to injury by any rough treatment short of cutting.

Unfortunately the makers of chains do not, as a rule, take the proper means to have their material inspected, and generally depend almost entirely upon tension tests and welding tests, and as long as no granulation appears the material is supposed to be satisfactory.

The proper manner to inspect and test this material is, to subject it to such treatment as it can be subjected to by rough usage, and then determine whether such handling will injure or develop dangerous qualities, or injure good ones.

With our present knowledge of materials, processes of manufacture, and accessibility of testing apparatus, there is no excuse for using material which is not of suitable quality for chains, or for any purpose whatever. The old test of applying a proof load is of no value whatever, as it does not discover defects which careful inspection could not reveal. Such defects which would be developed by this test only exist when the work has been carelessly, negligently, or cheaply made.

The fracture shown in the paper is distinctly that of a material unfit for chains, although of very excellent qualities for almost any purposes except where welding and hammering becomes necessary, or where accidental injury by percussion is possible or liable to occur.

This material, a fracture of which is shown in Fig. 210, would under normal conditions show a fracture as Fig. 212, when broken as described. The main trouble in obtaining the proper material would be the price that is asked for it; but as the cost of workmanship is generally greater in chains than that of the material, this should not be of primal importance.

Even considerable abrasion of running chains should not injure the material sufficiently to make it inferior, much less to cause rupture. Moreover, as electric welding is at the present day a complete success, as far as welding of similar pieces of cylindrical section is concerned, there should be no difficulty in obtaining the most perfect chains. Electric welds are guaranteed to have, under such conditions, fully 95 per cent. of the original bar section strength.

Fig. 211.

Fig. 210.

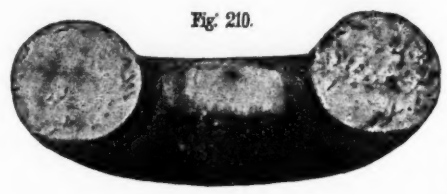
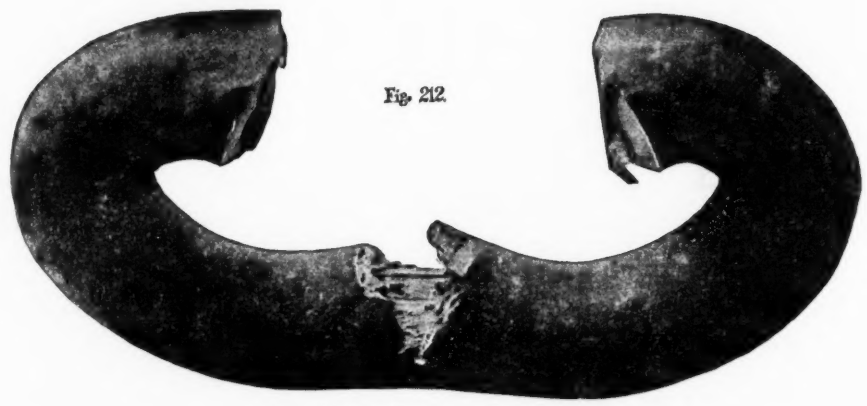


Fig. 212.



Crane Chains.—See Page 5.

LETTERS FROM PRACTICAL MEN.

The Pullman Porter.

Editor American Machinist:

You say a good and timely word for this much-abused public servant, and it is well deserved. The porter is expected by the car company to bleed the public or go without his pay, and he generally earns what little he gets by work that is not particularly heavy, but which must be unusually wearing. For example, I noticed once that the porter that left Minneapolis with me was still on duty twenty-four hours afterwards as we neared St. Louis, and in reply to my inquiry, he said that was his usual run. "I get so tired that I go to sleep while eating my supper. I have to be off early to-morrow morning, but I get a short day, as I get through at ten at night." I suppose the company favored the poor man with a short day's work of sixteen hours, in consideration of the fact that he had had twenty-four hours steady the day before. I did not grudge the quarter that man got for blacking my boots and answering a couple score of questions.

If the newspaper wits would turn their stream on the Pullman Car Co., and let the Pullman porter alone, they would show common sense, unusual in their line of business.

Geo. B. Grant.

That Cupola Explosion.

Editor American Machinist:

Ten years ago I had charge of foundry of Stearns Manufacturing Co., of Erie, Pa. While there I had an explosion in the large cupola, 50″ inside diameter.

In reading your article on Mysterious Explosion in cupola at foundry of Cassidy & Adler, N. Y., you ask for such experience from any one. I give mine with pleasure. After very close inspection next morning, of what was in cupola, I found out what caused the explosion. In the scrap used there was a piston 24″ diameter plugged up tight; the air thus corked in, as soon as heated up to the explosive point, burst the piston, making a loud report, blowing the bottom out of cupola, and everything came down. This took place five minutes after the blast was put on, and iron had just begun to drop from spout of cupola; happening at this time no fluid iron to fly and burn, no damage was done, none were hurt, only the loss of heat. Hoping the cause of late explosion may be found out, I am truly yours,

George Rogers.

Philadelphia, Pa.

Editor American Machinist:

In reading your paper I see account of an explosion in a cupola in the city of New York, on West Fifty-fifth street, and it is a mysterious occurrence to me, although I have worked at molding and served as foreman of a foundry for thirty-six years. Never heard of a cupola being blown up, although I have experienced something similar. On two occasions that I remember of, a shell was amongst some scrap metal that I had purchased, and through a mistake my melter got them in cupola on third charge, coming close to charging doors, and about half hour after the cupola was charged full and heated up, off went the shell with a loud report like a cannon, blowing a small portion of iron out top cupola, but no damage resulted. Now my belief is that the explosion described in your issue of July 18th may have been caused by a piece of pig-iron or coal that may have been loaded with dynamite by some desperate person. Still this theory may not be reasonable, and I would be very thankful to hear of some one else's opinion on the explosion. As far as crust gathering on top of mass in furnace, that is not correct.

Carlisle, Pa. J. K. Weaver.

Editor American Machinist:

Presuming there was not sufficient space between the lining and the shell of Cassidy & Adler's cupola for the mixture of air with carbonic oxide gas in sufficient quantity to cause such an explosion as reported in the American Machinist of July 31st inst., is it not possible, if there was scrap-iron used in the charge, that it may have been caused by an explosive such as gunpowder, dynamite or water, or something that would require heat to cause the explosion? I think the explosion may have been caused by an explosive encased in a thick, cast-iron shell covered with rust, dirt or clay, which protected it from the heat in the cupola until it got down to the melting bed, when the heat became sufficient to cause the explosion. Having twenty years' experience in a foundry, and never heard of such a thing before, is my reason for suggesting the above.

Racine, Wis. John Fennell.

Force of a Hammer Blow.

Editor American Machinist:

Reading your paper of July 10th, with great interest, I noticed Question 276—how to find the energy exerted by a drop hammer 400 pounds in weight, falling 5 feet.

Although the answer to this question is all right, it seems to me very difficult to put the right time of duration of the blow, in the given formula. I think it to be easier to take the measure of the compression after the blow has acted, and then calculate the mean force with which the hammer pressed the body.

The actual energy of the hammer after it has fallen 5 feet is

$$A = \frac{m \times v^2}{2} = W \times h,$$

wherein m denotes the mass of the hammer, v its velocity in feet per second at the beginning of the blow, W the weight of the hammer in pounds, and h the height through which it falls. Hence, $A = 400 \times 5 = 2{,}000$ foot-pounds. This actual energy must be consumed by the body during the time the hammer forms an impression on it.

If c denotes the compression of a certain body after the blow, then the mean force has been:

$$f = \frac{A}{c} = \frac{W \times h}{c} = \frac{2{,}000}{c} \text{ lbs.}$$

If, for example, the compression of a body, caused by the above hammer, is $\frac{1}{8}''$, that is $\frac{1}{8.12} = \frac{1}{96}$, then the mean pressure between the hammer and the body has been:

$$f = \frac{2{,}000}{\frac{1}{96}} = 2{,}000 \times 96 = 192{,}000 \text{ pounds.}$$

It is easy to understand that the force of the blow is in every moment equal to the resistance of the body, and it is very probable that this resistance is 0 at the beginning of the blow, and then increases gradually as the compression takes place, and reaches its maximum at the end of the blow. Therefore, the maximum force of the blow, referring to the last examples, would be,

$f\,max. = 2 \times 192{,}000 = 384{,}000$ pounds.

If it is assumed that the resistance of the body is always the same during the blow, then it is certain that this resistance cannot exceed very much the breaking strength of the body.

For example, a cylindrical piece of lead 6″ in diameter, and about 4″ or 5″ long has a cross-section of $\frac{6^2 \times 3.14}{4} = 28.27$ square inches.

The breaking strength for compression of lead is about 7,300 pounds per square inch, and if this be increased to 7,500 pounds, because the blow lasts but a very short time, then the total breaking strength of the above cylinder is:

$$f = 28.27 \times 7{,}500 = 212{,}025 \text{ pounds.}$$

If the given hammer, having 2,000 foot-pounds actual energy at the beginning of the blow, strikes upon this piece of lead, then the compression will be nearly

$$c = \frac{A}{f} = \frac{2{,}000}{212{,}025} = \frac{24{,}000}{212{,}025} \text{ inches.}$$

$$c = 0.113 \text{ inch.}$$

To find the approximate time of duration of the blow the formula could be employed:

$$v = r \times t,$$

wherein v denotes the velocity of the hammer at the beginning of the blow, that is

$$v = \sqrt{2 \times a \times h} = \sqrt{2 \times 32.2 \times 5} = 17.94 \text{ feet,}$$

r the retardation of the hammer during the blow, and t the time of duration of the blow; therefore,

$$t = \frac{v}{r} = \frac{17.94}{r} \text{ seconds.}$$

The retardation of the hammer is

$$r = \frac{f}{m} = \frac{f}{\frac{w}{a}} = \frac{a \times f}{w} = \frac{32.2 \times 212{,}025}{400}$$

= 17,068 feet per second. Hence:

$$t = \frac{17.94}{17{,}068} = 0.00105 \text{ second.}$$

It is certain that this way to find the compression of a body cannot in every case give a true result, and the result will be the more uncertain, the more perfect the elasticities of the striking bodies are. And as all the calculations about strength and elasticity are in some degree uncertain, so I think, in this and similar cases, the best result will always be obtained by practice or experience.

Mittweida, Germany. E. Luigi.

A New Slide Valve.

Editor American Machinist:

In presenting this valve to your readers I am actuated by two purposes, one of which is to dispel the mystery the makers seem desirous of investing it with, and the second is to enable engineers who may have this valve in use to understand it. Many of these valves have replaced ordinary slide valves, and riding cut-off of the Meyer type, and in some places have been placed on single-valve automatic engines. The main claims for this valve are based on the compression, and early release. It is claimed this is accomplished by means of the supplementary port (see Fig. 1), by which steam is transferred from one side of the piston to the other. The valve is shown at mid-travel, and is set at that position instead of the usual method. The makers seem more anxious about the compression and release than the admission, and in some cases admission does not take place until the piston has traveled 8 per cent of its stroke. The valve shown is at work on an 8″x14″ engine running at 140 revolutions. Referring to Fig. 2, let the outer circle represent the crank path, and the line *A B* the piston travel, with the points *A B* as the dead centers. Now, it was found that at the point *D* the valve was set in the position shown—mid-travel—and by dropping the perpendicular *D E* the crank is located at *E*. The inner circle shown has its diameter equal to the travel of the valve, 3.25,″ and therefore its center *O* is mid-travel for the valve. The perpendicular *C O*, then, shows the position of eccentric when the crank is at *E*, and it is obvious that when the crank reaches *A* the eccentric will have moved ahead through an angle equal to *A′ E′*. Taking this angle by the compasses, lay it on the inner circle, upward from the line *A B*, and locate the point *G*. From *G* as a center, with a radius equal to the steam lap, $1\frac{3}{16}$″, draw the lap circle. Now the line *A B* is found tangent to the lap circle, and therefore the valve is not open at the center *A*, but opens the instant the crank passes the center, and attains greatest port opening at *M*, at which position it opens an amount equal to *O L*, while cut-off occurs at *O H*.

The reader will see this method of analysis is that of Mr. Hugo Bilgram. The smaller circle with *G* for a center has a radius equal to the width of the supplementary port. It is plain that the valve, moving as shown by arrow, began to transfer steam from one side to the other, and this beginning is indicated at the point *N*, point *F* showing ports closed to exhaust. As the valve moves from the position shown, port *Y* will open to exhaust. Not till port *X* is covered by the bridge, then, can compression begin, while release *begins* at *F*. But the port *X* is not covered until the point *I* is reached. Nominally, compression is shown at *E* and *D*. Really, it is as much later as the value of the angle *F O I* is, and would be at *I′ K*.

Were the port *X* considered as negative lead, release would take place at *N* into the exhaust port. On the other hand, this port *X* is free to discharge into exhaust port between the points *F I*, and thus can equalize pressures in *Y* and *Z*, though the valve at this point is traveling at highest speed. The value, then, of this feature would depend on the compression, and it is easy to see that by adding a proper amount of inside lap one can attain the same results. For instance, assume the small circle to be a lap circle, then *N* would be compression and *I* release. Or assume the port *X* closed, the valve would have then no inside lap, and release and compression would occur simultaneously at *F*.

One fact brought forth by the sale of these valves is that there are many slide valves that are not properly designed, and a saving of fuel has resulted in a change. Many men, also, fail to see that a valve is set right, and thus a loss is incurred even with a good valve.

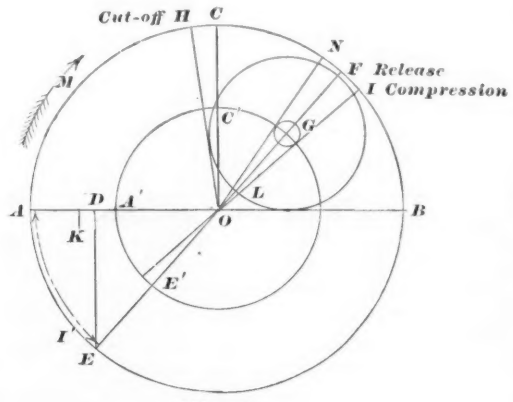


Fig. 2.

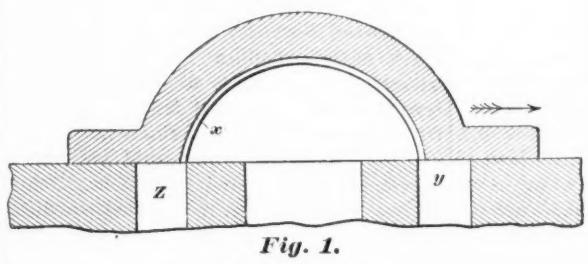


Fig. 1.

A New Slide Valve.

The port *X* is constructed by casting ribs in exhaust pocket, and attaching a plate of copper to the ribs by screws. From the above one can easily deduce the value of the valve over any decently designed slide valve.

Springfield, O. T. T. Parker.

Indexing.

Editor American Machinist:

I had thought the subject of indexing in connection with the B. & S. universal milling machine pretty well exhausted, when I read in last week's issue of your paper a communication from Mr. Gribben, giving a method of obtaining prime divisions above the limit provided for. I hardly think the example he gives would work well if the gear were of coarse pitch, or were required to work smoothly. It could be improved in the case of a gear of 61 teeth by using the 29 hole circle, and taking 19 holes for each division of the gear. It would then have an error of but $\frac{1}{1160}$ of the circumference to be compensated for by adjustment of the cross slide. I think the following method, however, will give better results, and with less manipulation, as the errors are so small that it is not necessary to correct them. If circles of 47 and 49 holes each be used, and the plate be turned back $\frac{23}{47}$ of a turn, while the index pin is moved forward (relatively to the plate) $\frac{24}{49}$ of a turn, the resulting change in position of index pin will be $\frac{1}{2303}$ of a turn, which corresponds to $\frac{1}{92120}$ of a revolution of main index spindle. As 61 is contained in 92120, $1510\frac{10}{61}$ times, it will require $\frac{1510\frac{10}{61}}{2303}$ of a turn of index pin to give $\frac{1}{61}$ of a revolution to main spindle — $\frac{1}{6}$ may be substituted for $\frac{10}{61}$ without sensible error, and multiplying by 6 we have $\frac{9061}{2303}$ turns of index pin for $\frac{6}{61}$ revolution of spindle. $\frac{9061}{2303}$ turns may be accomplished by moving plate back $\frac{5}{47}$ of a turn, and moving pin forward $4\frac{2}{49}$ turns. By cutting every sixth space round the gear the eleventh cut would be distant from first 0.01639166+ of the circumference, whereas, to be strictly correct, it should be 0.01639344+ of circumference, a difference of 0.00000178. By continuing the process of cutting every sixth space the gear will be complete in a little less than six revolutions, and the accumulated error between the last space cut and the first will be 0.00001068 of the circumference, which is probably no greater than exists in the majority of dividing wheels on gear cutting machines. The teeth of a wheel may also be cut consecutively. By moving the wheel $\frac{1510}{92120}$ of a revolution for each cut, and adding $\frac{1}{92120}$ at every sixth cut, a gear of 61 teeth may be cut with as much accuracy as by the foregoing method.

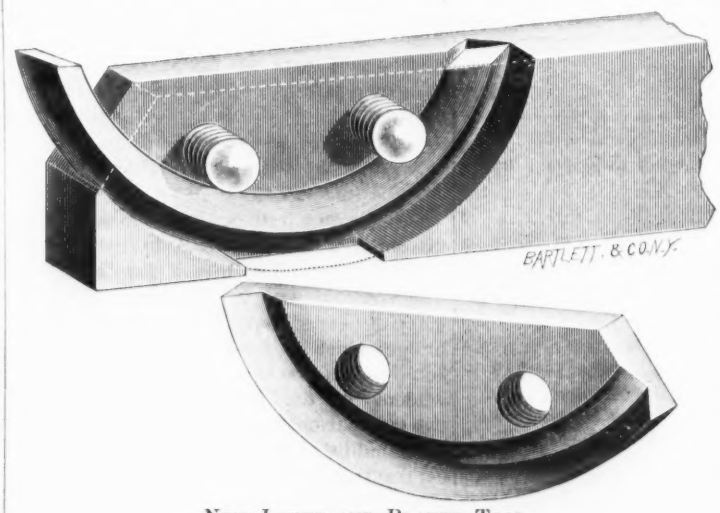
It is quite obvious that by the last method any number of divisions of the circle may be obtained, and, if correctly applied, the greatest possible error must be less than $\frac{1}{92120}$ of the whole circle. I hope my communication is not too lengthy. As I have seen nothing heretofore relating to approximately equal divisions of the circle, I am led to believe that it may be new to many as it was to me before I read last week's American Machinist.

J. V. Hamilton.

Wilmington, Del.

New Lathe and Planer Tool.

The engraving on this page represents a tool intended for use in the lathe or planer which belongs to that class of tools in which the cutter is held in a stock, which is fastened in the tool-post in the ordinary manner. The construction of the tool is clearly shown by the engraving, where it is seen that the cutter consists of a square rod of steel, which is simply bent to the arc of a circle, so that it conforms to a groove milled in the body of the tool, and in the cap which is shown detached, and is fastened in place by the two screws shown. When the cap is in place a cross-section of the groove in which the cutter is placed is square in form, and this adapts it to cutters round in section equally well. In the construction of this tool it has been the object to keep as near to the familiar diamond-point tool as possible, and, as will readily be seen, it is impossible to put any cut on the tool which will cause it to slip in the holder. The height and clearance of the tool can readily be adjusted, since raising it decreases the clearance, and *vice versa*. Raising the point to compensate for what is ground off also increases the top rake so that the tendency to lower the point in grinding is, to some extent, counteracted. Short lengths of cutters can be used by putting in a second short piece behind the one which does the cutting. Cutters can be ground in the holder or otherwise, as may be preferred, and the best steel can be afforded out of which to make them, as so little of it, comparatively, is used.



New Lathe and Planer Tool.

These tools are made by Berger Brothers, 240 Plymouth street, Brooklyn, N. Y.

Who Owns the Earth?

"A new class of troubles is now coming to the front," remarked Prof. A. S. Kimball at the Worcester Club. "Not many years ago a wire erected for any electric purpose had the whole field to itself. There were no neighboring currents to molest it, and the earth was universally used as the return of the circuit. Now when other companies begin to use the earth as a return, the delicate, sensitive instruments of the telephone company are affected. The question now comes, Who owns the earth? Our civilization demands the electric light, the telephone, the telegraph and the electric motor. Every extension of the service will necessarily call for some readjustment of existing systems, and vexatious problems will arise which will require wise legislation to solve. It is very desirable that no false alarms be raised to obstruct the real question at issue."
—*Boston Journal of Commerce.*

A Dangerous Machine.

A remarkable series of accidents has happened here, Sorel (P. Q.), within the past few days, by which three women are maimed for life, and which are worthy of record. On Monday of last week a widow named Picard, engaged in the steam laundry of the Richelieu & Ontario River Navigation Company, which is a large affair for washing linen used on the many boats of the line, while engaged in running a steam wringer, got her hands caught between two rollers, and before the machinery could be stopped her arm was drawn through with the linen and so terribly crushed that it was necessary to have it amputated immediately after, wards. Two days later Mrs. Piquette, who replaced the injured woman, met with precisely a similar accident. She, too, had to have her arm amputated. To-day another widow, named Benoit, also engaged in the laundry, managed to get her arm caught in the same unlucky wringer. She, too, was removed to the hospital, and this afternoon Dr. Latravers, after making every effort to save the arm, had to amputate it at the shoulder.—*Exchange.*

The new fire boat recently added to the fire department of Milwaukee is 106 feet 9 inches in length over all, with a mean draught of 9 feet; the total cost of boat and machinery was $30,745. The speed under 115 pounds pressure was 18½ miles per hour; one 4-inch stream of water was thrown—working two sets of pumps, steam pressure 115 pounds, a distance of 411 feet; four pumps, working under a pressure of 95 pounds, threw twenty streams through $1\frac{1}{4}$″ nozzles a distance of 146 feet. The chief of the fire department considers that in case of fire along the water front, or 700 to 1,000 feet back, this fire boat is equal to five fire engines.

Preliminary surveys have been made for the Pittsburgh & Virginia Railroad, which is generally regarded as an important enterprise. It will extend through the richest mineral regions of Virginia and West Virginia from Lexington, by the way of Uniontown to Pittsburgh.

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NEW YORK, AUGUST 14, 1890.

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The Application of the Indicator to Machine Tools.

In our issue of February 14, 1889, we noticed the fact that Prof. L. B. Breckenridge, of Lehigh University, had applied an ordinary steam engine indicator to a drill-press in such a way as to obtain the pressure required to force ordinary twist drills to their cuts, and we gave some of the results obtained by him. This was an entirely novel application of the indicator, and seemed to give promise of equally interesting and useful results when applied in other ways. It has since been so applied, and full details of the results will be found on pages 4 and 5 of the present number. The diagrams, which are exact photographic reproductions, will, we think, prove a very interesting study, and the arrangement of the planer, by which they were obtained, is so clearly shown as to make their intelligent study possible.

There is much room for experimental determination of the stresses to which cutting tools are subjected. In our issues of September 11 and 18, 1886, are some articles by Mr. James F. Hobart, describing his experiments with lathe tools, in which he used a dynamometer, through which power was transmitted to the lathe countershaft. Though the record of these experiments is interesting and useful, it will be seen that Professor Breckenridge's method is the better one, and we shall hope that much more will be determined by its use.

It is probable that the same tool used in a lathe to take similar cuts in the same kind of metal, at an equal speed, would be subjected to practically equal stress, in which case the present experiments answer equally well for lathes, though it is obvious that the same principle could be applied to the direct determination of stresses on lathe tools.

It is, perhaps, proper to say that the tools used in these experiments appear to have been such as could be conveniently picked up in the shop where the experiments were made, and, though not what we should call the ideal tools, are fairly representative of those found in the majority of shops. Nothing in regard to their "side rake" is said in the article, but in answer to our inquiry on this point the author states that the tool used for cast-iron had none, while that used on wrought-iron had a side rake of 5°. He further states that he gathered all the shavings in experiments 26 and 27, and placed them together to see how much compression there appeared to be, finding that they measured 9″, compressed from 12″, or a reduction in length of 25 per cent.

We consider that Professor Breckenridge has made a valuable addition to our stock of knowledge, and shown a method by which much more can be known. We shall hope that he will carry out his present intention of experimenting upon tools of various forms.

Some One Responsible.

On July 29 a train on the Erie road struck five children who were on a bridge over the Passaic River, killing three of them instantly. The children, who were returning from a berrying expedition, started to cross the bridge, which is intended solely for trains, and has two tracks, when they became bewildered by the simultaneous approach of two trains from opposite directions. The reports published say that the engineer of the express train saw them in time to make some effort at stopping, "but dared not apply the brakes suddenly, as that course might have sent the train through the bridge."

It is, of course, impossible to tell whether that is what the engineer thought or what some one else imagined he might have thought, but there are a hundred things which may make it of vital importance to stop a train as quickly as possible, whether on a bridge or not, and if the Erie road is running trains over bridges on which the engineers consider it unsafe to apply the full force of the air-brakes, an investigation should be made to ascertain whether or not this lack of faith in the bridges is well founded. If it is, then the quicker they are strengthened or replaced by others, the better. But if there is no foundation for this fear of them, then the engineers of the road should be held responsible if they run over people without making an effort to stop. When an engineer elects a certainty of killing children on the track as against a possibility of killing some of the people in his train, he assumes a very grave responsibility, and, if forced to do it from such a cause, the management of the road assumes a still greater one. At any rate, there should be no part of any railroad where it would be unsafe to make an emergency stop should circumstances demand it.

A Swedish Engineering Society.

We notice an announcement in the daily press to the effect that a new engineering society has been incorporated at Albany, which is to be called the American Society of Swedish Engineers, and we have to say that we cannot do otherwise than regard the movement as an ill-advised one.

We infer, of course, that membership is to be restricted to engineers who are natives of Sweden, but are engaged in the practice of the engineering profession in America, and if so, then we think that such men will find far more advantages in membership in engineering societies to which men are admitted upon a basis of their qualifications, independent of nationality. It seems to us that the greatest benefit for all concerned is to be derived from membership in societies where engineers from all parts of the world may meet to compare notes and experience. John Ericsson, who was the most noted Swedish engineer ever in this country, was a member of the American Society of Mechanical Engineers; but out of the thirty-two names appearing as incorporators of the new society we do not find one in the list of members of the A. S. M. E. Of course it is not probable that all these may be eligible for membership in that society, but there are others in which they would be. The disposition to divide into classes in this country, based upon nationality, is, we think, not a wholesome one, even in social organizations, where there is much more apparent excuse for it than in engineering or scientific bodies. The underlying principles of engineering are the same the world over, and the more interchange of ideas regarding them, and their application between individuals representing different countries, the better for engineers generally and everybody else, and we do not see how this interchange is to be promoted by separation into various societies, with membership based upon nationality.

The Electrical Execution.

A great many people and a great many newspapers are at present indulging in hysterics of the most violent type over the alleged failure and the awful cruelty of the execution of Kemmler by electricity. And yet it seems very clear that there was no cruelty more than is inherent in any execution, except so far as the effect of this one upon the spectators was cruel, and that was undoubtedly the result of gross bungling. So far as Kemmler was concerned, he was a base wretch, who showed no mercy for the defenseless woman whom he murdered. Nevertheless, as to whether or not the State is justified in putting such animals to death by any method is a debatable question. Assuming that such a right exists, it is still debatable as to which is the best method. We have never claimed, nor do we now claim, that execution by electricity is preferable to any other, but we have protested, and still do protest, against the evident effort to increase the mystery surrounding the subject, and to make it appear that no one knows whether or not electricity will kill.

To judge from the testimony of eminent physicians present at the execution, Kemmler was never conscious of physical suffering, and there can be no reasonable doubt but that the alleged horrible features of the case would have been entirely avoided had there been no bungling, or something worse than bungling. And now we suppose we are to hear more of the twaddle about the "debasement of a noble science," etc., about which we heard so much when the electrical execution bill was pending. By the way, we have not heard the name of the builder of the engine which drove the dynamo. We presume he has his money for it, and is now making other engines for any purpose for which they may be wanted, without a thought that his business is injured by this particular use of one of his machines. It would be far better for all concerned if the electricians could bring themselves to take an equally philosophical view of the matter.

Of Doubtful Expediency.

That clause in city contracts which permits the board having the particular matter in control to throw out any bids which it does not believe it for the best interests of the city to consider, is generally believed to be no more than the exercise of a necessary precaution; still it is doubtful if more harm does not come from its abuse than would come from leaving it out of such contracts. There is no doubt that in many instances men bidding the lowest in good faith—men perfectly competent in every way to do the work required—have their bids set aside under the working of this clause, in order that some favored bidder, who bids higher and understands dividing up better, may secure the contract. Specifications and contracts should be so drawn that there is no way of getting pay for the work unless it is properly done; then it does not appear as if there need be much fear of incompetent parties putting in low bids. It is evidence of lack of confidence in those who superintend, in the interest of the city, the work being done, to admit a fear that any contractor could get work accepted that was, in quality, below that called for in the specifications.

We were recently informed of an instance where a considerable sum of money was involved, and in which the bid of a firm, said to be entirely new to the particular line of work, was accepted, although their bid was more than 30 per cent. higher than that of another firm right in that line of work, and said to be entirely responsible and to have offered satisfactory bonds. All that came of the matter, so far as we learned, was a vote censuring the board that awarded the contract. The city must in this instance, as cities do in hundreds of instances—pay the loss.

The penalty for attempts—even though unsuccessful—to wreck railroad trains, when clearly proven, should be much more severe than it is. It is difficult to imagine a crime more fiendish and cowardly. Several attempts of this kind have been made during the past few weeks, and the authorities appear to have poor success in finding the perpetrators. Men so utterly debased as to attempt the murder of train loads of passengers, for any cause whatsoever, should be deprived of their liberty during the term of their natural—or unnatural—lives, and when such an attempt is made, the best detective force in the country should be put on the case. If the penalty for attempting to wreck a railroad train was made life imprisonment, without possibility of pardon, and it was known that no pains would be spared in hunting down the criminals, such attempts would become less frequent.

In our issue of May 29 we published an editorial article on the subject of Extension Fronts for Locomotives. In the current number of the *Locomotive Engineers' Journal* this article is reprinted without credit, and as though it had originated in the office of that journal, and has since been printed in other papers, which have innocently credited it to the *L. E. J.* All of which we should think would cause a vivid blush to mantle the cheek of ye editor, provided his blushing apparatus has not become clogged up, as some allege.

Boston citizens are waging a mild sort of war against the electric cars for running down people, and against the overhead wires

and high voltage—500-volt current. By the breakage of one of these wires not long since, two horses were instantly killed. This led the citizens to believe that here was a great danger to human beings, but the electricians, after some consideration, met this by the statement that in all probability the horse is more sensitive to electric shocks than a man. We are not aware, however, that any man has been found who was willing to submit himself to the same conditions as those under which the horses were killed. The reason for employing the high voltage is that with it small wires can be used, thereby making the first cost less.

QUESTIONS AND ANSWERS.

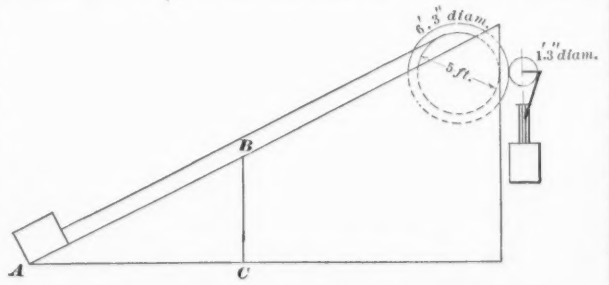
Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(313) A. E. M., Le Roy, N. Y., writes: We have a chimney 110 feet high, the cross-sectional area of the flue is 25 square feet. What is its capacity with natural draught? Also, what is its capacity with forced draught of four-ounce pressure? *A.*—With natural draught about 3,100 pounds of coal can be burnt per hour. With the given forced draught about 9,000 pounds of coal may be burnt per hour.

(314) R. H. B., Richmond, Va., asks: What is the highest recorded speed for both crank and rotary engines steady running? *A.*—We believe that the highest piston speed of a stationary engine that we have seen recorded is 1,200 feet per minute. The number of revolutions, and the maker's name of the engine we do not remember. A small engine at the De Lamater Iron Works used to be run at 1,200 revolutions per minute. We have no record of the highest speed of rotary engines.

(315) M. K., Williamsburgh, Ky., asks: Can you tell us whether whitewood is ever utilized in making any kind of wood pulp? *A.*—We referred this question to Mr. J. T. Horton, of the Lowville Iron Works Company, Lowville, N. J., manufacturers of machinery for pulp mills, who has kindly sent us the following reply: Poplar makes a very nice pulp, being white and soft. It is softer and not quite so strong as that made from spruce. When it is used in printing paper, one-third to one-half spruce is generally mixed with it. Nearly all the wood pulp mills in this section use both kinds of wood.

(316) G. B., New Jersey, asks: What load will an engine 11x15 inches hoist up an inclined plane whose height to its base is as 1 to 2? Pinion on engine shaft is 15 inches diameter; drum wheel 6 feet 3 inches diameter; drum 5 feet diameter; mean effective steam pressure 40 pounds per square inch. Please give rule. *A.*—In the first place we must determine the work which the engine is capable of performing, say during one revolution of the crank-shaft. The area of an 11-inch piston is 95.03 square inches; multiplying this by the steam pressure, we have a total pressure on the piston of $95.03 \times 40 = 3{,}801.2$ pounds. During one revolution of the crank-shaft the piston travels through a distance equal to twice the length of the stroke, which is equal to $1.25 \times 2 = 2.5$ feet; multiplying this distance by the total pressure on the piston, we have $3801.2 \times 2.5 = 9{,}503$ foot-pounds, which is the work the engine can perform during one revolution of the crank. In referring to the accompanying illustration, it will readily be seen that while the crank-shaft makes one revolution the drum must make $\frac{1.25}{6.25} = .2$ of a revolution. The circumference of the drum is 15.7 feet; consequently in making .2 of a revolution, the load will be hauled through a distance of $15.7 \times .2 = 3.14$ on the inclined plane. Lay off, on the inclined plane, from *A*, a distance of 3.14 feet, and thus obtain the point *B*, through this point draw a line *B C* perpendicular to the base; it will be found that the line *B C* measures 1.404 feet. This distance could have been computed, but the method given is the simplest. Hence when the load travels from *A* to *B* it is lifted through a distance of 1.404 feet. Now the load multiplied by the distance through which it is lifted must be equal to the work performed by the engine, namely 9,503 foot-pounds. Let x denote the weight of the load, we then have $x \times 1.404 = 9{,}503$; hence $x = \frac{9{,}503}{1.404} = 6{,}768.5$ pounds, which is the load the engine is capable of hauling up the inclined plane, under the assumption that there is no friction. The friction will of course depend on the condition of the inclined plane, and whether the load slides or rolls up the plane. Engine friction must also be allowed for. If the load is on rollers, the engine may haul a load of 5,600 pounds, that is, after friction has been allowed for.



(317) Torsion, Providence, R. I., writes: Kindly give me a simple method for computing the angle of torsion of solid and hollow shafts, when the diameter and length of shaft, and length of lever with weight applied, are known. *A.*—For determining the angle of torsion of a solid wrought-iron shaft of uniform cylindrical form, we use the same formula as given in the answer to Question 220 in our issue of June 5, current volume, namely

$$i = \frac{10.2 \times M \times x}{C \times d^4}$$

in which i denotes the angle of torsion in circular measure; M, the twisting moment in inch-pounds, which is obtained by multiplying the length of the given lever in inches by the load in pounds applied at one end of the lever; x, the length of the shaft in inches; d, the diameter of the shaft in inches; and C, the co-efficient of the transverse elasticity of wrought-iron, for which Rankine gives a value of 9,000,000 pounds per square inch. To show how the formula may be applied, we will take the following example: What is the angle of torsion in a shaft 3 inches diameter, 10 feet long, resisting a load of 1,000 pounds, applied to the end of a lever 18 inches long? The lever is attached to one end of the shaft, the other end of the shaft is fixed rigidly. The twisting moment is $18 \times 1{,}000 = 18{,}000$ inch-pounds. Substituting for the symbols in the formula their values we have,

$$i = \frac{10.2 \times 18{,}000 \times 120}{9{,}000{,}000 \times 3^4} = 0.0302,$$

which is the angle of torsion in circular measure. In circular measure we take the radius as the unit of measurement, and since the arc which subtends two right angles, or an angle of 180 degrees, contains 3.1416 radii, we can find the angle of torsion in degrees by the following proportion:

$$3.1416 : 0.0302 :: 180 : i,$$

which is equal to

$$\frac{0.0302 \times 180}{3.1416} = 1.73 \text{ degrees.}$$

For finding the angle of torsion in hollow shafts of uniform cylindrical form, the following formula may be used:

$$i = \frac{10.2 \times M \times x}{C\,(d_1{}^4 - d_0{}^4)}$$

in which d_1 denotes external diameter, and d_0 the internal diameter of the shaft, all in inches; the other symbols denote the same items as before. The angle found by the foregoing formulas will only be approximate, because the true value of C will depend on the quality of iron; and furthermore, these rules will give an approximate true result in cases only in which the shafts are not twisted beyond the elastic limit.

(318) A Reader, New York, writes: Please give me the rules for computing the load which solid iron bars of uniform rectangular cross-section will carry, the bar being supported at one end and loaded at the other, or supported at both ends and loaded in the center; also, when the load is uniformly distributed over the bar. *A.*—The following rule may be used for computing the load concentrated at the center of a horizontal beam, of uniform rectangular form throughout, made of any material, the beam being supported at both ends. Let l denote the distance between the supports in feet; d, the depth in inches; b, the breadth in inches; c, a constant, usually found by experiment, and W, the load in pounds. To find the load W we have

$$W = \frac{d^2 \times b \times c}{l} \qquad (1)$$

The value of the constant c will of course depend on the material of which the beam is made, and also on the nature of the load; that is to say, whether the load is one which will break the beam or a load which the beam can bear with safety. A cast-iron beam 1 inch square and 1 foot span will break with a center load 1,500 to 2,700 pounds (including one-half of the weight of the beam); we may take 2,100 pounds as an average; this 2,100 pounds is called the co-efficient or constant for the center breaking load, as it does not vary with the size of the cross-section beam; the quality of the iron is the only thing which will affect it. Wrought-iron will not break, but a load of 1,900 to 2,600 pounds is the greatest within the elastic limits which a wrought-iron bar 1 inch square and 1 foot span will bear; we may take 2,250 as an average, and this will be the value of the constant for wrought-iron beams. For safety in practice not more than $\frac{1}{4}$ to $\frac{1}{8}$ of these constants should be employed, depending on the importance of the structure, its temporary or permanent character, and the degree of vibration to which the beam will be exposed. If we adopt $\frac{1}{6}$ of the co-efficients of breaking loads, then for cast-iron beams formula (1) will become

$$W = \frac{d^2 \times b \times 350}{l} \qquad (2)$$

With this formula we find the safe load which a cast-iron beam of uniform rectangular cross-section, supported at both ends, can bear at the center. To illustrate we will take the following example: What will be the safe load placed at the center of a cast-iron beam 3 inches deep, $1\frac{1}{2}$ inches wide and $2\frac{1}{2}$ feet span? Here we have simply to substitute for the symbols in formula (2) their values and proceed as indicated by the signs; hence we have $\frac{3^2 \times 1.5 \times 350}{2.5} = 1{,}890$ pounds; from this we must subtract one-half the weight of the beam; say the beam weighs 40 pounds, then the total load which the beam can support at the center with safety is $1{,}890 - 20 = 1{,}870$ pounds. For wrought-iron we have

$$W = \frac{d^2 \times b \times 375}{l} \qquad (3)$$

which is the formula for finding the safe load which a wrought-iron beam will bear in the center, the beam being supported at both ends. The following table of relative strength of beams will enable us to compute the loads which beams supported and loaded in different ways can bear:

POSITION OF SUPPORT AND LOAD.	Relative Strength.
When firmly fixed at one end and loaded at the other	1
When firmly fixed at one end and the load uniformly distributed	2
When merely supported at one end and loaded at the center	4
When merely supported at one end and the load uniformly distributed	8

From the foregoing we see that, in order to find the load which a beam will support under various conditions, we may use the same formulas previously given with slight modification; for instance: To find the load which a horizontal cast-iron beam will bear, the beam being fixed at one end, and the load suspended from the other. Use formula (2) and divide the result by 4, and subtract one-half the weight of the beam. For wrought-iron beams we use formula (3) and then proceed as with cast iron beams. For a horizontal beam supported at both ends and loaded uniformly throughout, use formula (2) for cast-iron; (3) for wrought-iron, multiply the result by 2, and deduct the whole weight of the beam; the remainder will be the load which the beam can carry safely. For a horizontal beam fixed at one end with the load uniformly distributed use the same formulas as before, divide the result by 2, and from the quotient deduct the whole weight of the beam. The constants c here given are for loads at rest. If beams are subjected to jars, etc., a larger margin of safety should be allowed. It must also be remembered that the constants given have been deduced from small specimens free from important defects, and since large beams are generally more or less defective, a larger allowance for safety should be made.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Friday morning for the ensuing week's issue.

Lexington Cut Iron Gears. See adv. on p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N.Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. Vanderburgh, Wells & Co., 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.

Ice and Refrigerating Machines, 155 sold, and all successful. David Bovle, 521 Monroe st., Chicago, Ill.

Wrist-pin Machines. Pedrick & Ayer, Philadelphia, Pa.

Horizontal and Radial Drilling Machine. Pedrick & Ayer, Philadelphia, Pa.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Standard Tool Co.'s Twist Drills. S. A. Smith, 23 S. Canal st., Chicago, Western Representative.

Audubon Machine Works, New Haven, Conn. Special machinery, heavy and light.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

One Star Hack Saw will do as much work as five of any other kind.—N. B.

F. C. & A. E. Rowland, New Haven, Conn. Hydraulic, Mill and Special Machinery to order.

Send to H. W. Knight & Son, Seneca Falls, N.Y., for Catalogue of Metallic Pattern Letters and Figures.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

For best Return Steam Traps, Pressure Regulators Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson st., Chicago, Ill.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal st., Chicago, Western Agent.

Patent Attorney. R. G. DuBois, 715 11th st., Washington, D. C., procures first-class patents on inventions. Valuable Hand-book on patents free.

Horton's Chucks. We offer the balance of our stock at 50 per cent. discount. McFadden Co., Philadelphia, Pa.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See August 7, p. 19. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

25" Upright Drills a specialty. Finely made, 28" great capacity, quickly operated, prices low. 32" Send for list of firms using our Drills. J. E. 36" Snyder, Worcester, Mass.

25" 32" 37" 42" "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

For Sale—Bound volumes of the Patent Office Gazette for years 1883, 1884, 1885, 1886, 1887 and 1888. Price, $4 per year. Address J. C., care of AMERICAN MACHINIST.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt st., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines. T. C. Dill Machine Co., Philadelphia, Pa.

Screw Propellers. Manufactured by H. B. Roelker, 22 Cortlandt st., New York. Superintendent of the late De Lamater Iron Works, of same patterns and designs as before, adapted to each vessel. Consulting Expert and Constructing Engineer. Estimates on machinery, damages, etc. Air ice machines.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram; also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th st., New York.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton st., New York.

MANUFACTURES.

North Billerica, Mass., offers free land to manufacturers.

The erection of an electric light plant is talked of at Marion, N. C.

The carpet-mills of Smith & Sons, Yonkers, N. Y., are to be enlarged.

The Stoughton Hosiery Company is to be incorporated at Stoughton, Mass.

Beard & Son, of Greenville, S. C., will erect a foundry in Spartanburg, S. C.

A $150,000 cotton factory is to be built at Wytheville, Va., by Baltimore money.

Another electric light plant is being erected at Laredo, Tex., also water-works.

A $30,000 chair factory will, it is reported, be established at Williamsport, Md.

A company is organizing at Carnegie City, Va., to establish a $100,000 furniture factory.

J. H. Wells will at once erect a two-story machine shop at Tampa, Fla., 40x96 feet.

Another factory for the manufacture of insulator pins is to be erected at Waynesville, N. C.

The Fitchburg Steam Engine Company, Fitchburg, Mass., contemplates an enlargement.

W. C. & L. S. Cater, of Greenville, Ala., will, it is stated, erect a saw and shingle-mill in Milton, Fla.

The works of the Chicago (Ill.) Crucible Steel Casting Company, were recently destroyed by fire.

A $150,000 company has been organized at Roanoke, Va., to erect and operate a furniture factory.

A $400,000 stock company will, it is reported, be organized, to erect a cotton-mill at Henderson, Ky.

Dreyfus & McMillan, of Walnut Lake, have made a proposition to move their stave factory to Pine Bluff, Ark.

A large sugar refinery is to be added to the industries of Galveston, Tex. The company will have $250,000 capital.

The Bibb Manufacturing Company, of Macon, Ga., is reported as to erect a $100,000 cotton-mill at Covington, Ky.

A recent fire at East Saginaw, Mich., burned the planing-mill of H. B. Neare & Co. and the saw-mill of Brown & Ryan.

It is believed that the Framingham Gas, Fuel and Power Company will erect a gas plant at South Framingham, Mass.

E. C. Wiley will probably organize a stock company to manufacture his patent electric railway signal, at Bristol, Tenn.

Hackney Bros., of Wilson, will probably move their buggy factory to Greensboro, N. C., and increase capacity of same.

The Long Island Cotton-mills Company is enlarging its mills by the addition of improved cotton machinery, at Monbo, N. C.

Joseph Davis, a wealthy shoe manufacturer of Boston and Lynn, Mass., will establish a shoe manufactory at Glasgow, Va.

J. F. Cochran and others, of Philadelphia, Pa., are investigating with a view of establishing a cotton-mill at Charleston, S. C.

The Lookout Iron Co., of Chattanooga, will move its rolling-mill to Harriman, Tenn., where it will be improved and enlarged.

The Hartford (Conn.) Board of Trade has formed a company, which will erect a building 45x350 feet, to be leased to manufacturers.

A $200,000 stock company is reported as organized, to erect a furniture factory, tannery, glue and button factory, at Columbus, Miss.

A stock company with $50,000, at Ft. Worth, Tex., has been organized, to enlarge the plant of J. Dohlman Refrigerator Company.

William Thatcher, of Belmont, is erecting one of the largest oil-mills in Central Texas. The mill will very soon be put in operation.

The Mobile, Jackson & Kansas City Railroad Co. has made the city a proposition to erect machine shops and roundhouse at Jackson, Miss.

It is said that a bicycle factory, for the manufacture of children's bicycles, to employ 300 to 400 men, is to be located at Springfield, Mass.

The Easton Manufacturing Co., of Easton, Md., has increased its capital stock to $200,000, and will, it is stated, enlarge its washing powder factory.

C. R. Leonard, W. T. Elbin and J. H. Covington have purchased an acre of land near Easton, Md., and will, it is stated, erect a roller process flour-mill.

The Fiberwood Company that recently built a pulp-mill at Livermore Falls, N. H., has voted to increase its capital stock to $75,000. The plant will be extended.

Morgan Iron Works Company have been incorporated by W. E. Lucas, G. W. Nicholls and others. They will erect a plant at a cost of $25,000, at Spartanburg, S. C.

Samuel Newton, of Xenia, Ohio, and others have incorporated the Chattanooga Powder Co., to establish gunpowder-mills at Ooltewah, Tenn. The capital stock is to be $50,000.

The Chicago (Ill.) Watch Tool Company has been organized, to manufacture and sell machinery; capital, $10,000; incorporators, Julius Heinemann, Louis O. Keltz and Emil Heinemann.

C. H. Mitchell & Co., of Chicago, Ill., have been incorporated, to manufacture elevators, etc.; capital, $100,000; incorporators, Charles H. Mitchell, Wallace, Thomas and John P. Ahrons.

The Consumers' Ice Co., of Chattanooga, Tenn., with a capital stock of $50,000, has been incorporated by Edward Kohn, W. J. Shamouski, H. T. Bowman and others, to erect an ice factory.

The Wayne Woolen-mill Co. has been organized at Wayne, Me., to operate the woolen-mill, which has been idle for two years. The capital stock is $50,000. A good many improvements will be made.

C. W. Mackey, W. H. Forbes, Philip Engelskirger and others have incorporated the C. R. Smith Plating Co., to manufacture wire plate metallic stock, etc., at Newport, Ky. The capital stock is $2,500,000.

The Charlotte Harbor Phosphate Company, of Charlotte, Fla., will be chartered in August, when works will be erected. Paid capital, $400,000. John L. Hammond, of Savannah, Ga., can give information.

The Ingalls Iron and Coal Co. has been incorporated by Judge McLaughlin and others, with a capital stock of $5,000,000. They will erect iron works and develop coal mines at Waynesboro, N. C.

The Florence (Ala.) Iron Works, in which Fall River citizens are interested to the extent of $100,000, are expected to be in operation in October. Subscribers to the stock have just paid in their second assessment.

The Cincinnati Corrugating Co., who removed their works to Piqua, Ohio, some time ago, have issued a new catalogue showing the different styles of corrugated metal made by them, and the method of using it in buildings.

The "Swift" Lubricator Company, of Elmira, N. Y., have issued a new catalogue, which contains much information regarding their lubricators and the methods of applying and using them. Those interested should send for it.

The United States Electric Car Company, Chicago, Ill., has been incorporated, to manufacture electric cars and motors, and operate the same; capital, $3,000,000; incorporators, M. R. Debolt, J. H. Donnelly and John A. Qualey.

A new grist-mill and machine shop is being erected near the site of the old starch factory at Franconia, New Hampshire. It is owned by Bostwick & Wolcott, and the company expects to commence a good business in the fall.

The National Forge and Iron Company, of East Chicago, is building an addition to its plant to manufacture muck bar for its own use. A separate building will be erected to contain several puddling furnaces and a train of muck rolls.

The Rice Mfg. Co. has located at Fitchburg, Mass., for the manufacture of ladies' and gents' underwear. The plant is now in partial operation, but it is expected that much more machinery will be added, and the business largely increased.

The Beaver Tube Company, chartered with a capital of $1,000,000, at Wheeling, W. Va., will start work on the plant and build a town near Lewisburg. A big coal and coke enterprise will also be begun in connection with the works.

James Sullivan and W. K. Burton, of Tennessee, W. C. P. Smith, of Maryland, and others, have incorporated the Rome Brick and Building Company, to establish brick and sewer-pipe works, etc., at Rome, Ga. The capital stock is $200,000.

The Columbia Street Car Company, Chicago, has been incorporated, for the manufacture and operation of cars and machinery and railway appliances; capital, $1,000,000; incorporators, Patrick R. McArdle, Freeman J. Short and Arthur H. Walker.

The Farmers' Agricultural Implement Manufacturing Company, Springfield, Ill., has been incorporated, to manufacture all kinds of agricultural implements; capital, $25,000; incorporators, J. H. Vanarsdale, A. B. Bronson, John Lindsay and others.

The Idler Gold Mining Company has been organized by Boston (Mass.) capitalists, with W. P. Jones, secretary, to develop gold land near Marion, N. C. Will put in quartz mining machinery and build chlorination works. The capital stock is $1,000,000.

Land for a grain elevator has been deeded to a company at Richford, Vt., $1,200 having been raised to purchase the same, and the company will locate its works here. Three hundred hands, it is said, will begin work at once on the foundation and buildings.

The Thomson-Houston Electric Light Company are putting in a 1,300 incandescent light dynamo at Burlington, Vt. This will give them a capacity for 2,600 incandescent and 100 arc lights. The engine power will soon be increased and electric motors will be added.

J. D. Smith & Co., of Cincinnati, Ohio, have issued a new catalogue, which is of especial interest to foundrymen, as it contains descriptions and illustrations of almost everything used in modern foundries. They contract to furnish complete outfits for foundries.

It is stated at Tredegar, Ala., that negotiations that have been pending between the Jacksonville Mining and Manufacturing Co., and northern and foreign capitalists, have successfully terminated, and a steel-working plant, to employ 3,000 men, is to be established.

A new cotton-mill will soon be in operation in Kearney, Neb. The foundations of the proposed mill at that point have already been started. The mill proper is to be 408x100 feet, and about 600 hands will eventually be employed. The capital invested is about $500,000.

It is said that the woolen-mill now being built at Richland, N. J., will be the largest in the State. The stock of the new mill is owned by parties in New York, Philadelphia and Richland, two of the principal owners being C. W. Jones, of Richland, and E. R. Wood, of Philadelphia.

The Framingham (Mass.) Gas, Fuel and Power Company, organized some time ago, has bought land of ex-Governor Wm. Claflin, on Irving street, made contracts for its gas machinery, and will start at once putting in the works. The company is capitalized at $75,000, all of which is paid in.

McGrath & Collins, of Cohoes, N. Y., have issued a catalogue of emery grinding, polishing and buffing machinery. Most of the machinery illustrated is fitted with McGrath's patent yielding or rigid journal-box, illustrated in our issue of November 21, 1889. Those who do much grinding will find matters of interest in the catalogue.

A new foundry is being erected for the Pratt & Cady Company at Hartford, Conn. The building will be 250x75 feet, and it is the intention of the company to have a traveling crane run the entire length of the building, besides a large number of jib cranes scattered throughout the wings, all of these cranes to be operated by electricity.

The Waltham (Mass.) Emery Wheel Company propose to erect a new building to double its present capacity. The Central Massachusetts Railroad will run a spur track to the works. The new building will be 24x90 feet, with second story extending back nearly 100 feet. The office will be two stories, 30x40 feet. There will also be new engine and boiler-rooms.

The Schenectady (N. Y.) Locomotive Works are compelled to refuse orders for engines to be finished within a year, as they have orders on their books which will keep them busy for that length of time. Full night and day gangs are working. The capacity of the works has been increased in the past two years from 350 a year to 600, or two locomotives for each working day.

The Electric Engineering Company has filed articles of incorporation in the Camden (N. J.) County Clerk's office. The objects are to construct electrical railways, cars, etc. Harvey Barton, Henry Gianella, Christian Schneider and Thomas Marion, of Philadelphia, and Charles Richter, of Camden, are the incorporators. The capital stock is $100,000, of which $5,000 is paid.

It is stated that the Jacksonville Mining and Manufacturing Company, at Tredegar, Ala., has completed negotiations with Eastern and foreign capitalists for the building of large steel works, to include rolling-mill, steel-mill, etc., and to employ, when completed, 3,000 men. The company which proposes erecting the plant also intends constructing a system of water-works.

What will be the largest woolen-mill in New Jersey, when completed, is now being erected at Richland. A syndicate of capitalists from New York, Philadelphia and Richland are interested in the new mill, which will be devoted to the manufacture of all kinds of woolen goods. The stock of the new Richland Mill is owned principally by E. R. Wood, of Philadelphia, and C. W. Jones, of Richland.

The bulk of the funds with which the new smokeless powder factory, located in Wayne County, W. Va., will be started, is said to come from the Phœnix Powder Company, of New York. Work will begin at an early day for the erection of the factory. It will require about $150,000 to put it in operation, and it will give steady employment to 250 hands. It will be the only place in the country where smokeless powder is manufactured.

Work will soon begin on the new building projected by the Waltham Emery Wheel Company, at Waltham, Mass. The company contemplates putting up a building 24x50 feet, with second story extending back over 90 feet. The office building will be 30x40 feet, two stories high. The engine and boiler-rooms will each be 18x32 feet. The new factory will give employment to double the present number of employes, or about 100 men.

The National Tube Works at East Boston is to make extensive improvements on its plant on Mill street. The old building used as a storehouse is to be torn down, and a new brick structure 102x43 feet, 2½ stories high, will be erected in its place. The lower floor will be used as a storeroom and the second for the finishing of injectors. The lathes in the main shop will be put in the new building and six new ones added. A new horizontal boiler of 90 horse-power will also be put in.

A company has been formed with a capital of $200,000, for the purpose of erecting large car shops at Montgomery, Ala. The company has purchased 15 acres of land and is about to contract for $35,000 worth of machinery. It will break ground for the buildings about September 1. At the head of the company is Charles Webster, of Phillips, Wis.; the general manager is Captain Burr, of Stephens' Point, Wis.; and the general superintendent is Edward Gilbert, of Oshkosh, Wis.

Hartford, Conn., is to receive another new industry. The Holt Manufacturing Company, that has been carrying on the manufacture of firearms and tools at Springfield, has decided to remove there, and the machinery is now being removed. The company will enlarge its capital through the aid of Hartford capitalists, and will extend its business. Quarters will be obtained in Colt's Armory, where the Graphophone Company was located. No efforts were made to keep the industry at Springfield.

The Chapman Valve Company will erect a new factory addition to its present plant at Indian Orchard, Mass. The building will be 120x50 feet, of brick, three stories high, with tower 20x20 feet. Many departments in the company's works will have to be changed by this new move, and the new addition put up last year will be taxed to its fullest capacity on floor space. A brick blacksmith shop, 50x70 feet, will also be erected near the new addition, and one of the buildings left vacant will be converted into a box shop.

The Chapman Valve Company will increase its plant at Indian Orchard, Mass., by the erection of a new factory. The building will be 120x50 feet, of brick, three stories high, with tower 20x20 feet. A brick blacksmith shop, 50x70 feet, will also be erected near the new addition, and one of the buildings left vacant will be converted into a box shop. The company now employs 220 men, and the addition will materially increase this number. The new building will be used in part for the manufacture of a new style of valve.

The Colwell Iron Works, 74 Cortlandt street, New York, write us: "Last month we met with a fire in our works, which destroyed the larger portion of the roof of our foundry, the other departments not being destroyed. This accident decreased the output of the foundry about 60 per cent. We have, however, arranged for the repair of the roof, and at the same time will add 100 feet to the foundry, which, with our new cupola, will make an output of 50 tons per day. The loss by the fire was $11,000, fully covered by insurance."

The Chester Foundry and Machine Co., Chester, Pa., write us, under date August 1, 1890: "We beg to say that we have work now for two years ahead, and that under the circumstances we are gradually withdrawing our advertisement from all papers. We are extending our shops and adding new tools and machinery. We have been able to trace not less than $50,000 of the work to our advertisement in the AMERICAN MACHINIST, and wish to assure you of our continued appreciation and gratitude for what you have done for us. We expect in a few months to enlarge our notice, and will then call upon you again."

The Pittsburgh (Pa.) Reduction Company, the only manufacturer of aluminum for commercial purposes in the United States, is preparing plans for the erection of an immense new plant. Several sites up the Allegheny and Monongahela Rivers are now under consideration, and one is likely to be decided upon in time to begin work this fall. Nearness to the natural gas or soft coal fields is the most important requirement for the new site, and the one offering the greatest promise in this respect will be selected. It is proposed to erect a plant with 10,000 horse-power, and to give employment to a large additional force of men.

The foundation for the new foundry building to be erected for Doherty Brothers, of Ayer, Mass., on the Pawtucket Canal, is completed, and work has been commenced on the walls. The firm will probably move its foundry from Ayer here in September. It employs about fifty men. A mill 130x75 feet, four stories high, is to be erected on the site of the mill recently burned, which was occupied by Allen & Cheney, box manufacturers. The building is to be completed by Nov. 1, and will be occupied in part by the Amraytoon Paper Tube Company, which company is now building new machinery that will give them about four times their present output.

The firm of J. J. Wysong & Co., of New York City and Glauchau, Saxony, is about completing one of the most extensive plants in the world for the manufacture of dress goods. The works are to be located at Passaic, N. J., and will be carried on by a company incorporated under the laws of that State. The name will be the Botany Worsted Mills, capitalized to the amount of $1,750,000, and all paid in. The mill will start with about 800 looms, employing 1,000 persons. If the venture proves successful the capacity will be doubled within two years. The stockholders of the company mostly reside at Glauchau, and are considered to be the most successful and energetic business men in that section.

A special from Lynn to the Boston *Daily Advertiser* says: "Superintendent E. W. Rice, Jr., of the Thomson-Houston factories, has patented a current and switch-controlling mechanism, which is designed not only to make it possible to stop electric cars quickly, but which will prevent the car going at all unless the driver's hand is upon it. It covers the combination, with the electric controlling devices of an electric railway motor, of a retractor, tending to move the controlling device into position to decrease the power of the motor, or throw it out of action, and a manually-operated actuator for the controlling mechanism, constantly free to return to position of stoppage under the operation of the retractor."

The enterprising firm of Thos. Carlin's Sons, of Allegheny, have purchased a large plot of ground on Roer ave., Allegheny City, between two railroads and a river front, which makes the site a very desirable location for shipping purposes, on which they have put in a switch and scales of the West Pennsylvania R. R., and a switch from the Pittsburgh & Western R. R. At present the firm is taxed to its full capacity with orders, and in order to increase their facilities they have commenced to put up a structural iron building for a foundry 100x200 feet, in which they contemplate putting up a traveling crane for handling heavy castings and loading on cars in the shop when finished. Have also a new cupola of their own design and improvement, capable of melting 15 tons per hour. Carlin's Sons, in order to show how they appreciate the services of their workmen, have offered to put all departments in their employ on 9 hours as a day, at present wages, after the first of September.

A special from West Lynn, Mass., to the Boston *Daily Advertiser*, says: "Electrician Hermann Lemp and Superintendent John Tregouing, of the welding works, have patented a new apparatus for electrical metal working. It covers the combination with the sliding clamp in an electrical welding machine, of a guide rest having internal passages for circulation of a cooling medium. It is of cast-metal, such as copper, provided with circulating tubes or pipes enclosed in the casting. Mr. Lemp has secured a patent for forming or shaping metal by electricity, consisting in putting the metal into an electric circuit between two clamps, molders or abutments, adapted to be moved toward one another, passing a heating electric current from one holder, or abutment, to the other, through the piece, until it attains the desired plasticity, interposing a die or device between the holders or clamps, and in abutment with the heated metal, and then applying suitable force to move one or both holders or clamps, and squeeze the die or forming device and the heated metal together. The Thomson-Houston Electric Company will immediately build a 500 horse-power dynamo, twice as large as any it has yet constructed, of the style patented by Professor Thomson last week."

A Hand Sewing Machine.

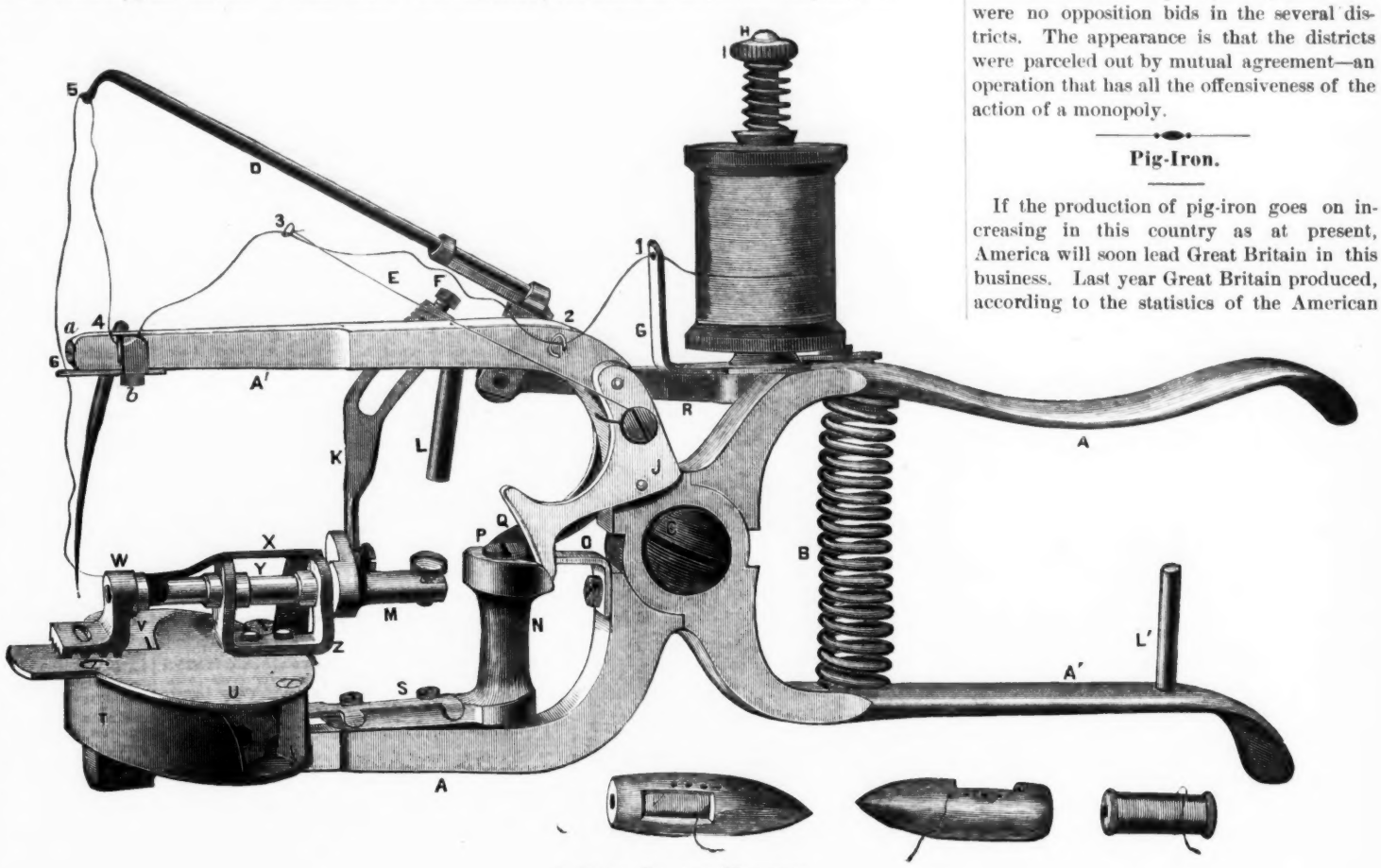
The engraving on this page represents something of a novelty in the way of a sewing machine, which is intended to be held and used in one hand, after the manner of a barber's clipper. As will be seen, all the most essential parts of a sewing machine are present in this, modified to suit the general object in view.

To the needle arm *A'* are attached all the various devices by which motion is imparted to the various other working parts. The shuttle lever *S* is moved by the cams *J* and *Q*. The presser foot and feed are combined in one piece *W*, which is lifted at the proper time by the pin *L* coming into contact with the head of the screw below it, while it is moved from side to side to produce the feed by means of the connection *K*, the amount of motion thus given to it being controllable by adjusting the screw *F*, thus changing the length of stitch. *D* is the take-up, and the tension is regulated by means of the knurled nut *I*. The engraving, which is full size, makes the construction plain, and it will be seen that while it will not, of course, compare with the large machines for speed, it is much faster than sewing by hand in the ordinary way, and the stitch compares very favorably with that of much more elaborate machines.

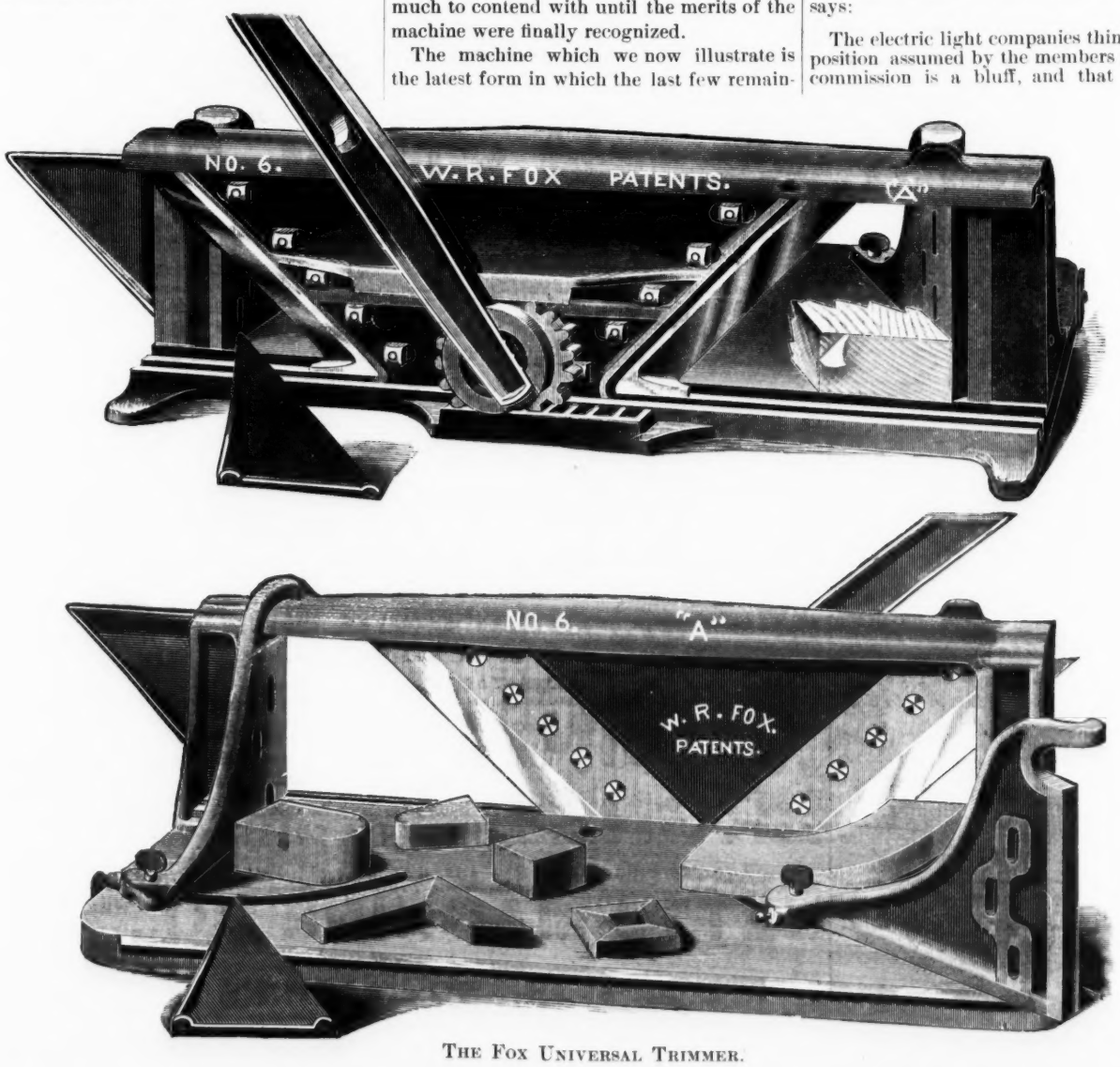
It is made by the Hand Sewing Machine Co., Bridgeport, Conn.

Mr. Fox, the inventor of this machine, is a practical pattern maker, and the machine is the direct outgrowth of his recognition of the fact that such a machine would be of great service in such work. He therefore became the pioneer in the making and introduction of trimming machines, and, as usual with those who do pioneer work, found much to contend with until the merits of the machine were finally recognized.

The machine which we now illustrate is the latest form in which the last few remaining difficulties are thought to have been entirely overcome. As will be perceived, the blade of this machine extends for a little distance below the bed, and is so formed that it is impossible for the blade to be drawn into the bed by the heaviest cuts, as has sometimes happened in the former machines. The large number of these machines which have gone into use within a few years past attests their growing popularity and usefulness. They are made in six sizes by the Fox Machine Co., Grand Rapids, Ind.



A HAND SEWING MACHINE.



THE FOX UNIVERSAL TRIMMER.

The Fox Universal Trimmer.

We present herewith illustrations giving two views of the "Fox" universal trimmer or mitering machine, designed for the use of pattern makers and others who have many joints to make in wood.

Pig-Iron.

If the production of pig-iron goes on increasing in this country as at present, America will soon lead Great Britain in this business. Last year Great Britain produced, according to the statistics of the American Iron and Steel Association, 8,322,824 gross tons, while the product in the United States was 7,603,642 gross tons. But the increase in production in the United States, compared with the previous year, was seventeen per cent., while in Great Britain it was but four per cent.

There is in the United States a decrease in stock, as compared with one year ago, of 162,984 gross tons, but this does not imply a probability of under-supply in the near future. The new furnaces building, or completed since the first of January, together with the old ones in blast, or likely to be, will undoubtedly be more than equal to supplying the demand. The Southern States are exhibiting great activity in the building of furnaces, and are seeking an outlet for their products. This will, and undoubtedly does affect prices favorably to the consumer all over the country. This country has little need of importing pig-iron, except brands that cannot be produced here.

Speaking of the effort of the electric light companies to increase the price paid by the city for light, the *Commercial Advertiser* says:

The electric light companies think that the position assumed by the members of the gas commission is a bluff, and that they will finally pay the prices charged, as it would be disastrous, in a political way, to shut off the electric light before a municipal campaign.

We know nothing of the merits of increasing the price for electric lights from 29 cents to 45 cents, but if the city's rights in the matter are to be concluded by the probable effect upon partisan politics, then it is about time a reformation was brought about. The weak spot in the electric light companies' armor is, as we have before pointed out, that there were no opposition bids in the several districts. The appearance is that the districts were parceled out by mutual agreement—an operation that has all the offensiveness of the action of a monopoly.

The determination of the large print-cloth manufacturers, of New England, to close their mills during one week of August, is apparently a wise one. Print-cloth manufacture has been profitable, and the business has been overdone, so that with present prices for cotton and labor, the manufacturers say there is no profit in the business. No one will deny that the price of labor is low enough, and it is probably better for all parties to decrease stock, which is large, by stopping production for a week, than to go through the ordeal of, and attempt to cut down wages, with the attendant strikes and lockouts.

Safety in Electric Lighting.

By courtesy of Mr. C. J. H. Woodbury we have received a copy of the Rules and Regulations advised by the Boston Manufacturers' Mutual Fire Insurance Co. for the installation of electric lighting and motive apparatus.

Our lack of space forbids quoting it entire, and any partial quotation would fail to do it justice. It is sufficient to say that, like all other publications proceeding from this source designed for education in the art of avoiding fires, it is of great value to owners and operators of manufacturing plants. In

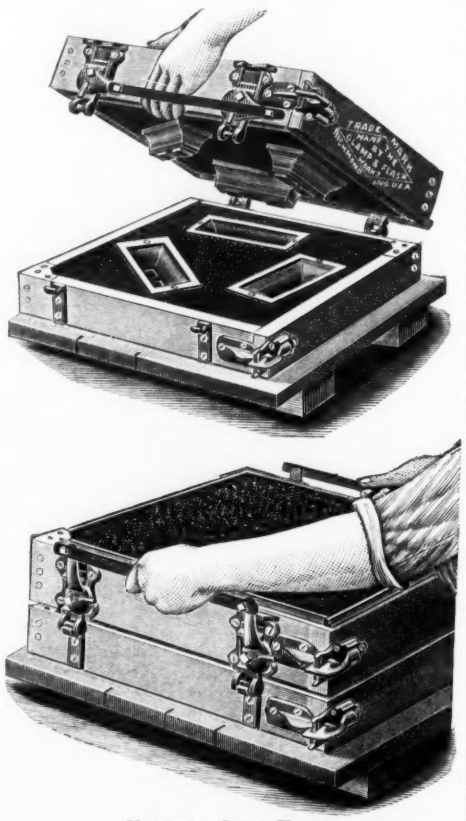
the introduction it is stated that "There has not been a loss from any fire which could be attributed to electricity, generated for purposes of lighting or for motive power, in any mill or works insured by this company. The experience for ten years has sustained our position that a well-installed electric lighting system is the safest method of illumination."

The Diamond Folding Snap-Flask.

We present herewith illustrations of a new snap-flask for molders' use. This flask is intended particularly for use where a larger flask is required than can easily be lifted direct by the molder, and is so arranged that by drawing the two parallel bars toward him, the molder thereby lifts the cope vertically one inch. It can then be rolled off to either side, as shown by Fig. 2, the eccentrics for lifting the cope vertically, and the hinges upon which it turns, being alike on each side. The levers and eccentrics on one side being independent of those on the other side, the molder can lift the cope as the work may require, one side at a time, or both sides together, and retains the same "feel" as when lifting by hand. By this improvement it has been found possible to use much larger flasks than where all the lifting is done by hand, and a considerable advantage is thereby secured.

They are manufactured by machinery, bound with special irons, and are knocked down and folded up for convenience in shipping. The manufacturers are the Diamond Clamp and Flask Works, Richmond, Ind.

The Brady Manufacturing Company, of Brooklyn, N. Y., who, among other things, manufacture the Fitch Type Writing Machine, have just completed and shipped to England a complete plant of special tools for their manufacture by a company which has recently been organized there for the purpose. The tools sent will give a capacity of about fifty machines per day, and a number of sets of parts, ready for assembling, were shipped with them.



Folding Snap-Flask.

The conclusion is being pretty swiftly reached that the monster guns on some of the modern British war-ships do not comprise the most desirable armament. There is failure in the instance of many of these guns, and the probability of their being disabled early in action by the fire of six-inch and eight-inch guns is strongly dwelt upon.

Machinists' Supplies and Iron.

New York, August 9, 1890.

Iron—American Pig—No change of importance has taken place during the week, the market having continued to rule quiet and steady, although in the South some tendency to shade prices has been manifested.

We quote Northern No. 1 Foundry, $17 to $18; No. 2, $16 to $17; Gray Forge, $15 to $15.25; Southern No. 1, $17 to $17.25; No. 1, Soft, $16.50 to $16.75; and No. 2, $16 to $16.25.

Scotch Pig—The demand has been moderate. We quote Eglinton, $19.25 to $19.75; Dalmellington, $21 to $21.50; Coltness, $23.50 to $24.

Bar—The demand has been fairly good, and the market firm.

We quote Common, $1.85; Medium, $1.90; Refined, $1.95 to $2 for round lots on dock.

Copper—Compared with the business that has been done for some time past, the week's business has been dull, though, of course, the volume of trade is still very large. The demand seems to indicate, however, that consumers have their immediate wants pretty well supplied, and are not much concerned about the future. The Calumet & Hecla Company's price for this month's deliveries is 17c., with somewhat higher figures for future deliveries. Arizona Ingot is quoted at 15c.; casting brands, 14¾c.

Lead—The market has been very dull, and prices have fallen somewhat, being now at about 4.45c.

Spelter—The demand has been moderate, but sellers have been firm.

We quote ordinary brands of Western, 5.45c. to 5.60c. Choice, 5.70c. to 5.75c. Refined, 6.75c. to 7c. Silesian, 7c. to 7.25c.

Tin—The market has ruled dull, but steady, though there have been indications of weakening. Values range from 20.90c. to 21c.

Antimony—There has been no change of note during the week, the supply of Regulus remaining somewhat limited, and prices firmly maintained. We quote Hallett's, 21c. to 21¼c.; Cookson's, 23¾c. to 24c.

Lard Oil—The demand is moderate, and it is selling at 49c. to 50c. for prime.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Mechanic is open for position on fine fitting and filing on small machines. Box 57, Am. Machinist.

Wanted—A job to design and construct some new machine. Address Expert, Am. Machinist.

Wanted—A competent draftsman, also an assistant draftsman, for machine shop in Brooklyn. Address Box 58, American Machinist.

Wanted—A foreman, to take charge of the forging department of bolt and nut works. Address, giving age, experience, salary expected, Bolts, Am. Mach.

Wanted—A first-class draftsman for designing engine and general work. State age, salary and references. Robt. Wetherill & Co., Chester, Pa.

Wanted—Mechanical draftsman; must be steady, rapid, and preferably a good penman. Address Post Office Drawer 5110, Boston, Mass.

Wanted—A position as foreman, by a practical man, in boiler-shop or shipyard; best of references furnished. Address P. W., American Machinist.

Wanted—A position as foreman of milling machine dept. in shop doing interchangeable work; best reference. Address M. M. F., Am. Machinist.

Wanted—Opening by college graduate, technical ed. in engineering and chemistry: practice as draftsman and stationary engr. Box 295, Andover, Mass.

Wanted—Machinist experienced in testing steam-engines 2 to 25 horse-power; must be of good habits, and not over 35 years old. Address Troy Engine & Machine Co., Troy, Pa.

Wanted—A foreman in a shop making fine brass work. A tool maker accustomed to duplicate work, with some knowledge of drafting, preferred. Address, with references, Phila., American Machinist.

Wanted—Good machinists; vise or machine hands; steady work and good wages to first-class men. Address Frick Company, Waynesboro, Franklin Co., Pa.

Wanted—A boiler-shop foreman, capable of handling one hundred men on marine work. Write, stating terms and giving references, to Box 55, American Machinist

Wanted—A first-class molder, to take charge of our new brass foundry, experienced with yellow brass and figure molding; give full particulars. Gorham Mfg. Co., Silversmiths, Providence, R. I.

Wanted immediately A competent man to act as assistant foreman and layer-out in a large boiler shop. Address at once, with references, The Bigelow Co., New Haven, Conn.

Wanted—Position as office manager by reliable young man; unquestionable habits; would take charge of Western branch; valuable advertising experience. L. E. O., American Machinist.

Wanted—A position as foreman, by a first-class machinist, tool maker and draftsman, 36 years of age, sober and industrious; has held similar position for shop making fine tools for interchangeable work. Address Box 59, American Machinist.

Wanted—A foreman for Blacksmith and Hammer Dept's, at Pittsburgh Locomotive Works, Pittsburgh, Pa. Must be temperate and thoroughly understand the business. State wages expected, and address applications to the Company.

Wanted—A position as superintendent or foreman by a practical mach., 12 years in charge of works, building port. and stat. engines and boilers. Would build engines on contract or take interest in sound concern. Address Sup't, American Machinist.

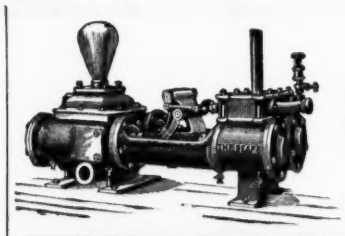
Position as draftsman wanted; 14 years' experience as machinist and draftsman; technical school graduate; late charge of drawing-room employing ten men; sober, honest, industrious; New York city or vicinity preferred. Address J. K., Am. Machinist.

Wanted—By young man, position as supt. or foreman of machine works; practical tool maker and machinist; thorough knowledge of Brown & Sharpe's grinders; used to close interchangable work; best refs. Address Box 13, Simsbury, Conn.

Wanted—As foreman of our machine shop, live, active young man, who has executive ability to handle men and work; state age, experience, and salary wanted. Buffalo Forge Company, Buffalo, N. Y.

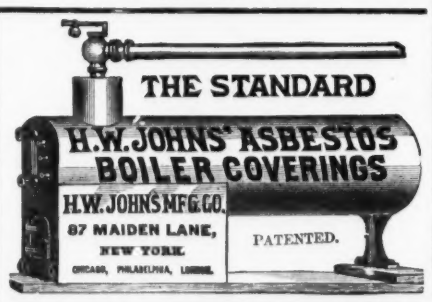
Wanted—Machinists and metal pattern makers; a steady employment given to capable men; works are being greatly enlarged; town near Chicago, is rapidly growing and has an excellent climate. Haxtun Steam Heater Co., Kewanee, Ill.

BRADLEY HAMMERS AND FORGES
BEST HAMMERS IN THE WORLD RUN BY BELT
OVER 1500 IN USE.
Three Styles, 15 lb. to 500 lb. Heads.
Our FORGES heat irons fast enough to keep Hammers and Men fully employed. Send for Catalogue and Prices.
BRADLEY & CO., SYRACUSE, N. Y.
14 WARREN ST. NEW YORK. 96 & 98 SUDBURY ST. BOSTON.



THE DEANE
OF HOLYOKE
STEAM PUMPS
DEANE STEAM PUMP CO.,
HOLYOKE, MASS.

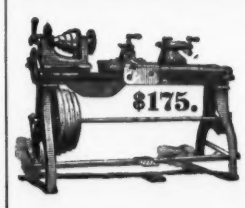
CIRCULAR CATALOGUE V.
Steam-Engines, Boilers, Locomotives, Steam-Heating, Etc.
JOHN WILEY & SONS,
2d door west of Broadway. 53 E. Tenth St., New York.
Free By Mail on Order



ASBESTOS CEMENT FELTING,
FOR LAGGING LOCOMOTIVE BOILERS.
Samples and Descriptive Price List Free by Mail.
We are prepared to take Contracts for applying Steam Pipe and Boiler Coverings in any part of the United States.
H. W. JOHNS MANUFACTURING CO.,
87 Maiden Lane, NEW YORK.

BEST STEEL
For Taps, Dies, Punches, Milling Cutters, Lathe and Planer Tools, Cold Chisels, Edged Tools and Hardware of all kinds.
CRESCENT STEEL CO.,
136 FIRST AVE., PITTSBURGH, PA.
64 & 66 So. CLINTON ST., CHICAGO, ILLS.
430 PEARL STREET, NEW YORK, N. Y.

Beaman & Smith, PROVIDENCE, R. I. 21-In. Lathe

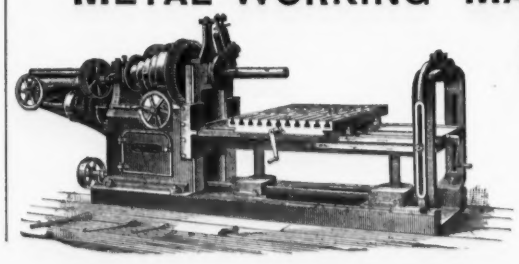


Improved Screw Cutting Foot and Power LATHES
Drill Presses, Shapers, Band, Circular and Scroll Saws. Machinists' Tools and Supplies. Lathes on trial. Catalogue mailed on application.
THE SEBASTIAN-MAY CO., 167 W. 2d St.,
CINCINNATI, O.
MONTGOMERY & CO., 105 Fulton St., New York, Gen'l Agents.

TOBIN BRONZE
Send for Circular.
Tensile Strength upwards of 79,000 lbs. per sq. in.
Torsional Strength equal to the best Machinery Steel.
Anti-Frictional and Non-Corrosive.
CAN BE FORCED HOT.
Rods for pumps and bolts. Yacht shafting. Rolled sheets and plates for pump linings and condenser tube sheets, &c. Spring wire.
ANSONIA BRASS & COPPER CO.,
CHICAGO. Sole Manufacturers, NEW YORK.

GEO. F. BLAKE MANF'G CO.
BUILDERS OF EVERY VARIETY OF
95 & 97 LIBERTY ST., NEW YORK. 111 FEDERAL ST., BOSTON.
WATER WORKS PUMPING ENGINES A SPECIALTY

BETTS MACHINE CO., WILMINGTON, DEL.
MAKERS OF
METAL-WORKING MACHINE TOOLS
FOR
Locomotive, Bridge & Engine Builders, Railroad, Car & Machine Shops
AND
Iron and Steel Works Generally.



Wanted—To add to office force in large shops in Chicago, one or two draftsmen experienced in Corliss and general engine designing, also one or two draftsmen experienced in mill building, constructions and general machinery. Address Box 40, AMERICAN MACHINIST.

Wanted—A progressive boiler maker to take charge of a large boiler works on stationary, portable and marine boilers. Must have large experience with men, and be well up in the use of latest improved tools and appliances. Best of reference required. Address Q., AMERICAN MACHINIST office, stating particulars and salary expected.

Wanted—Foreman for our pattern shop, a pattern maker who is master of his trade, who has a good education and a thorough understanding of drawings, and who has had experience in architectural iron work; a permanent position and a good salary to a competent man. Address The Snead & Co. Iron Works, Louisville, Ky.

Machinists Wanted—First-class floor hands and fitters of large experience and of good habits can find steady employment and liberal wages. Address Morgan Engineering Company, Alliance, O.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Cheap 2d-hd lathes & planers. S M York, Clev'd, O.

Koopman's Scales for quick measurements.

Just out; aluminum-steel hack-saws, hard but not brittle. Crescent Mfg. Co., Cleveland, Ohio.

New catalogue of engineers' specialties free. Crescent Mfg. Co., Cleveland, Ohio.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Turned and Highly Polished Iron and Steel Shafting a specialty. Merwin McKaig, Cumberland, Md.

Wanted—Customers for our new Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

Complete list of our Scales and other new tools for 2c. stamp. A. T. Koopman, Chicago.

Engineers wanted to send their addresses and receive free a 25 cent book, "Hints and Suggestions for Steam Users." Lord & Co., P. O. Box 1262, Phila., Pa.

The present address of L. C. Morgan, machinist, is very much desired by his wife, on account of sickness in the family.

Wanted—To buy second-hand lathes, planers and shapers of all sizes. Must be cheap and in good order. Fosdick & Plucker, 6th and Culvert Streets, Cincinnati, O.

R. G. & Co. having secured the American Patent for their Fuel Economizer for Steam Boilers would be glad to treat with some good firms as to agency for same. R. Gosling & Co., Hadleigh, Eng.

Wanted—A 10-inch hot-air Rider pumping engine, second-hand, but must be in good condition and at a low price. Rogers & Ordway, 180 to 184 East Fourth street, St. Paul, Minn.

Wanted—Engineers to write for Catalogue of all the latest and most valuable mechanical, scientific and electrical books which are given free with each barrel of the Pittsburgh Boiler Scale Resolvent. Pittsburgh Boiler Scale Resolvent Co., Pittsb'gh, Pa.

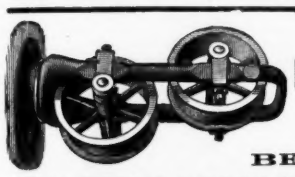
For immediate delivery. Wright's patent 17-inch friction shapers; best and cheapest made, with every latest improvement. Send for circulars and prices to J. D. Wright & Sons, 392 Smith street, Brooklyn, N. Y.

Wanted immediately—One first class tool-room lathe, 20" swing, 4' between centers, with tapering attachment; state maker's name and price; also, want a good pit lathe, to swing 30'. Address Fraser & Chalmers, Fulton and Union streets, Chicago.

NICHOLSON FILE COMPANY,
PROVIDENCE, R. I.

FILES AND RASPS
FOR EVERY VARIETY OF WORK.

SEND SAMPLE.
We make a specialty of all kinds of screw machine work and do it cheaper than you can.
WRITE FOR PRICES.
BLAUVELT & HALDY,
Factory, Pearl & Front Sts., Brooklyn Office, No. 258 Broadway, N. Y.



GUIDE PULLEYS FOR LIGHT BELTS.
JOHN ROYLE & SONS, PATERSON, N. J.

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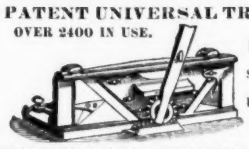

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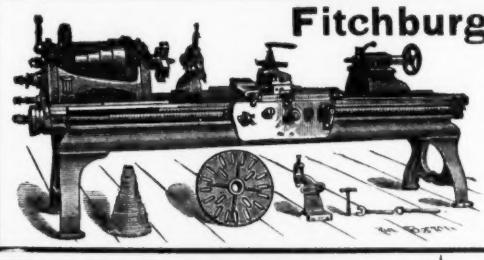

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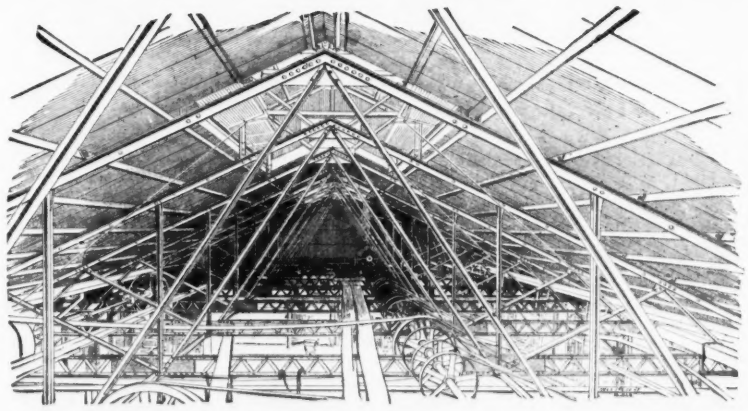

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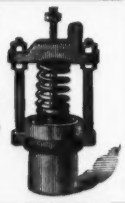

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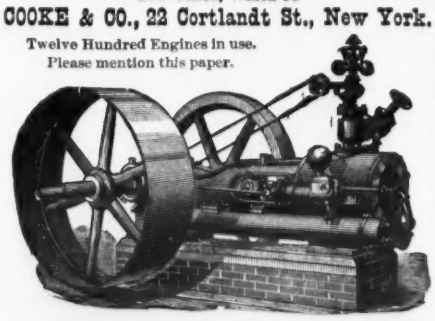

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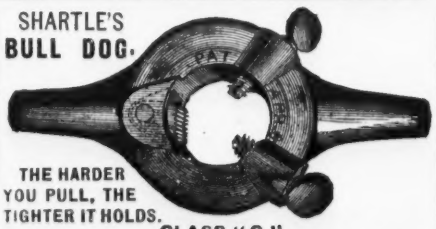

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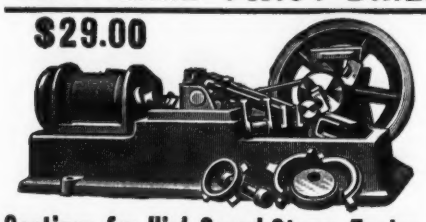

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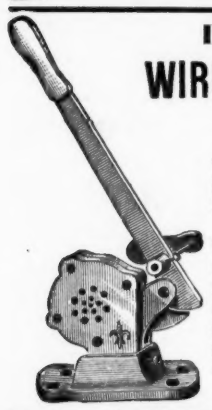

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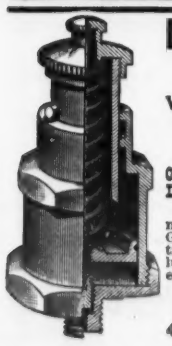

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Foundry Practice, Various Articles on. By Robt. E. Masters, appearing in 16 issues.
Strength of Different Mixtures of Cast-iron and Method of Testing. By Robt. E. Masters, April 24.
Foundry Practice, Articles on. By Foundryman. [L. C. Jewett.] Aug. 14, Sept. 25, Dec 18.
Foundry Practice, Articles on. By S. Bolland, May 8, 22 29, June 26. July 10.
The Morton-Poole Roll Grinding Lathe. By Joshua Rose, J. G. Tramis, Geo. H Babcock and C. A. Smith, July 3, 24, Aug. 7, 14, 21, Sept. 25.
Machine Shop Cost and Time Accounts. By A. J. Shaw, Henry Metcalfe and C. A. Burton, April 3, 17, May 8.
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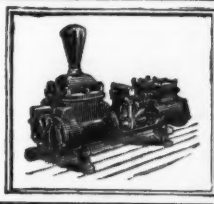

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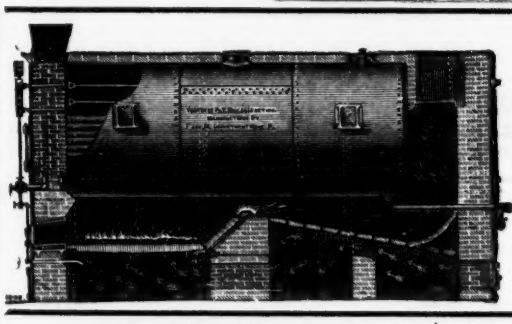

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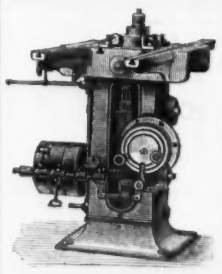

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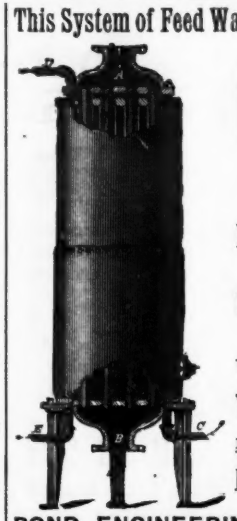

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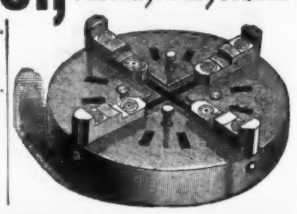

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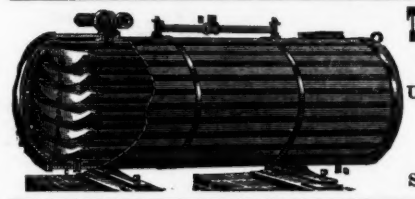

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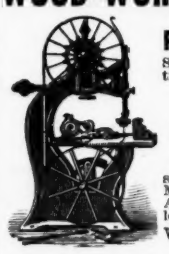

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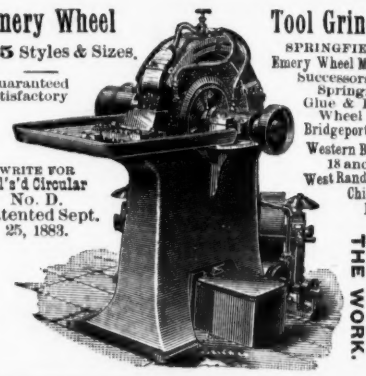

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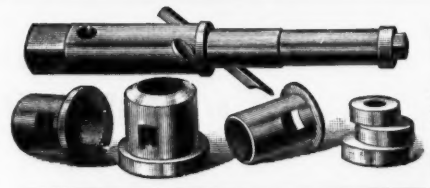

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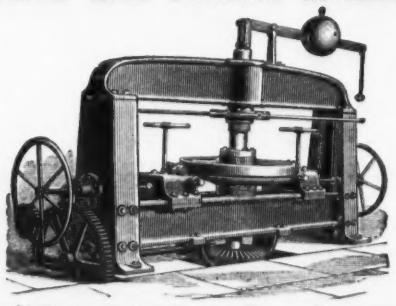

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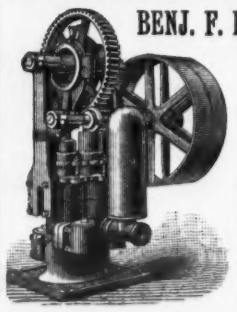

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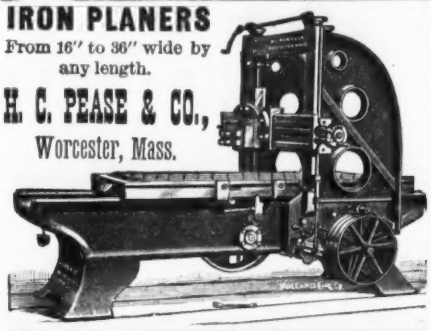

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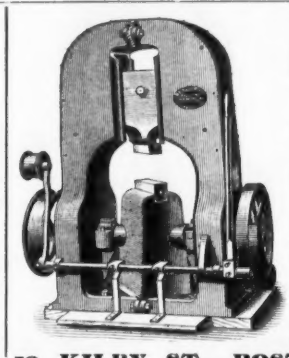

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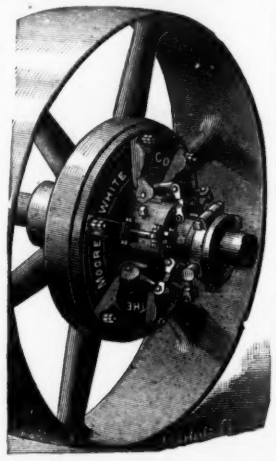

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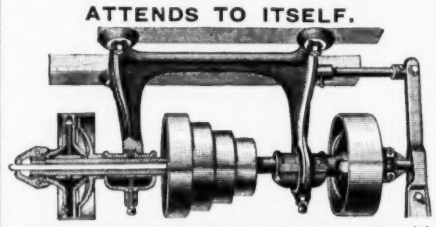

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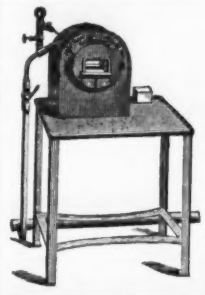

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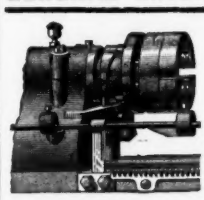

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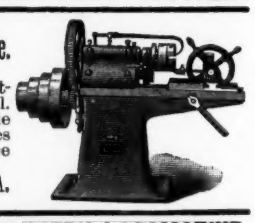

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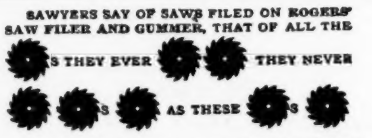

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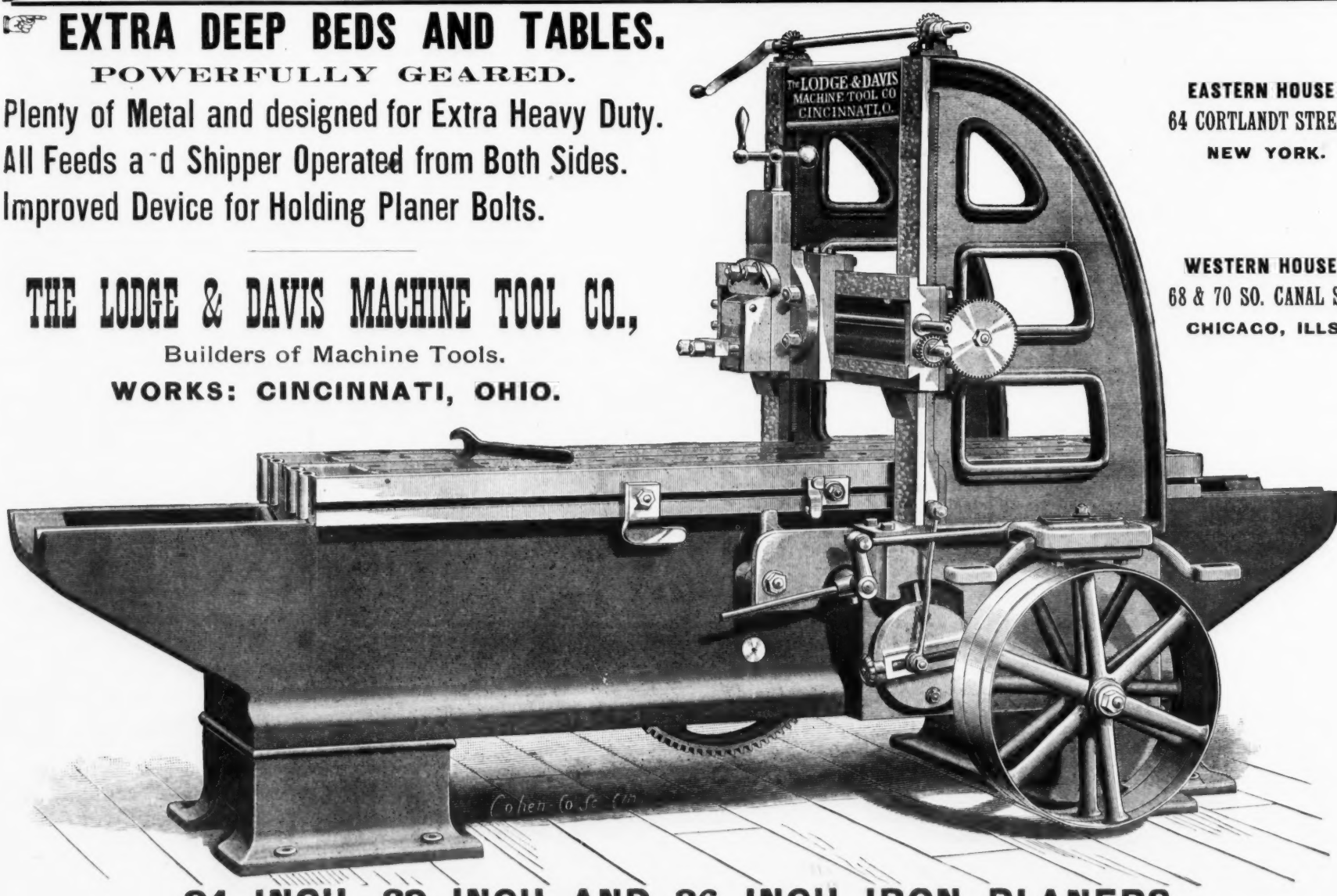

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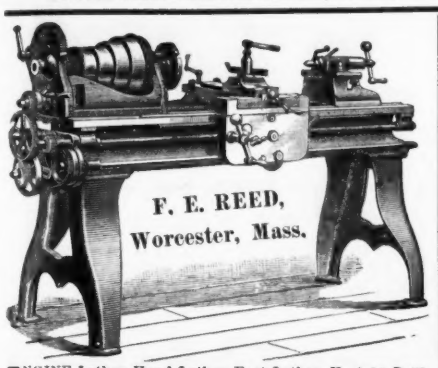

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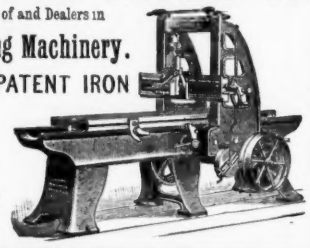

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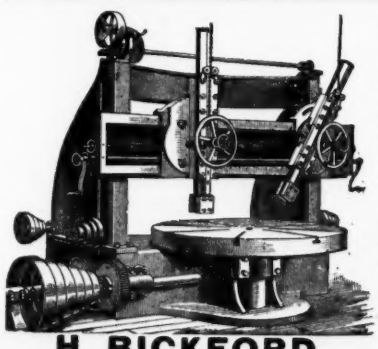

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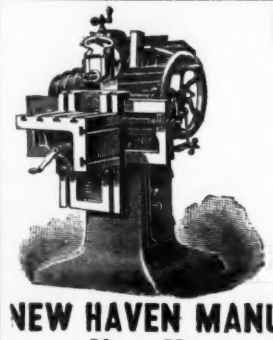

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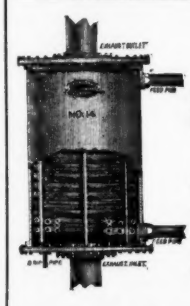

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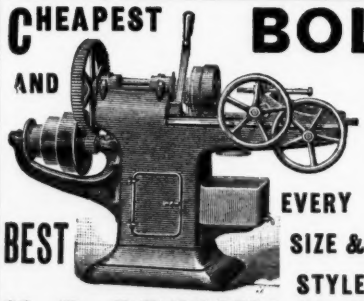

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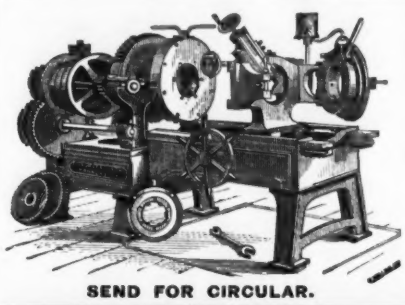

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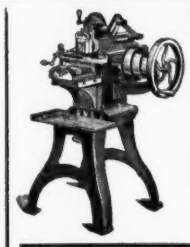

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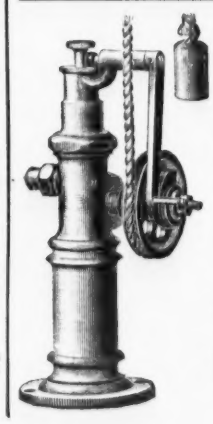

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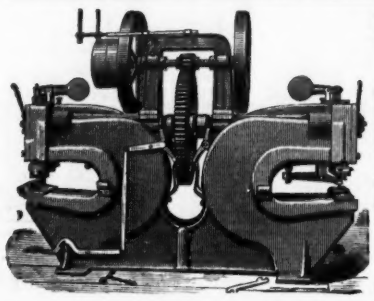

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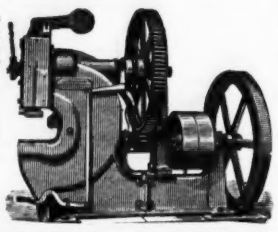

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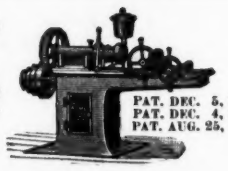

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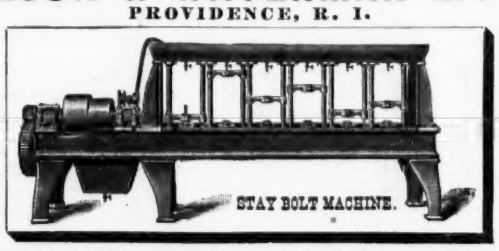

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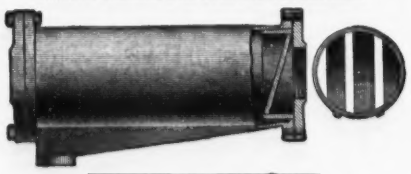

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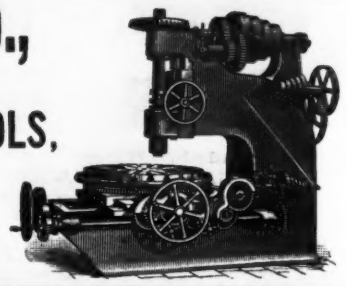

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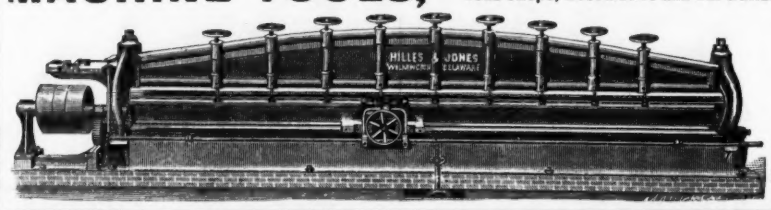

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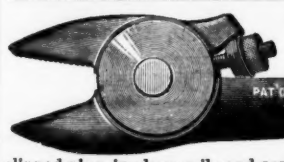

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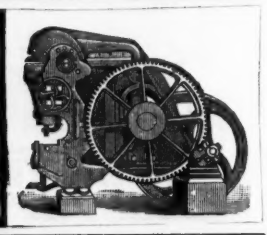

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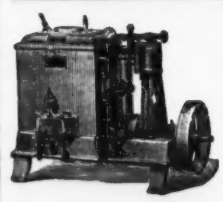

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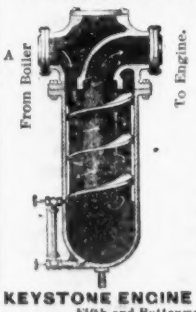

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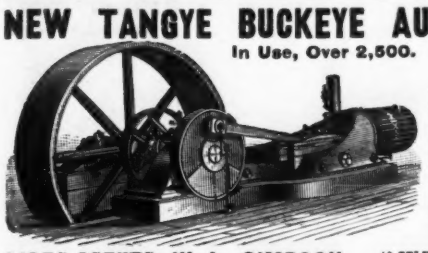

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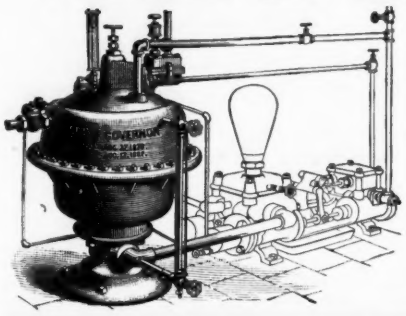

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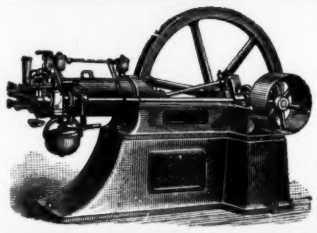

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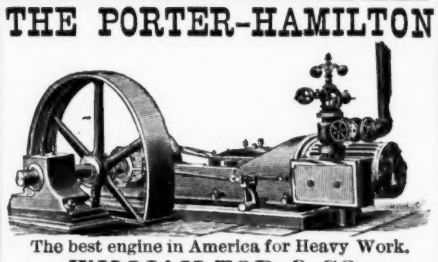

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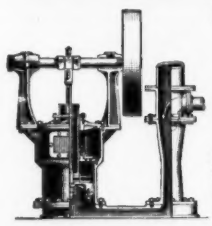

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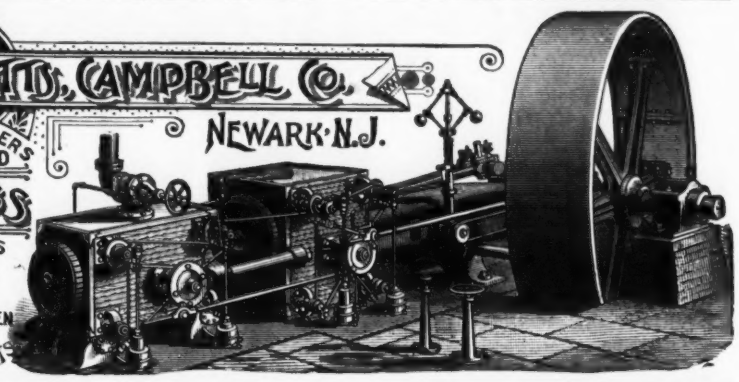

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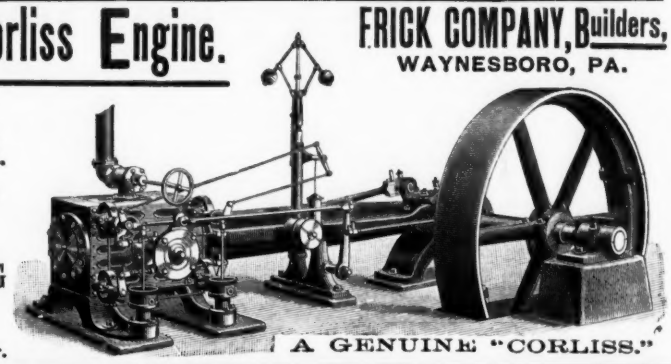

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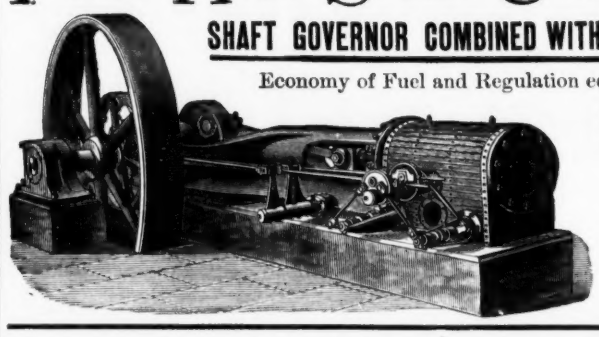

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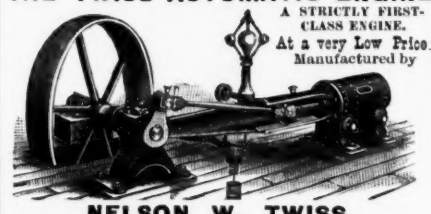

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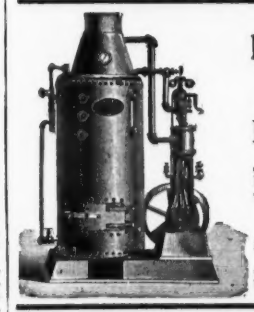

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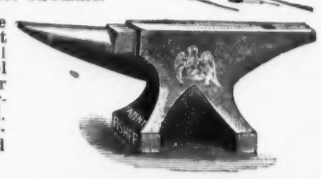

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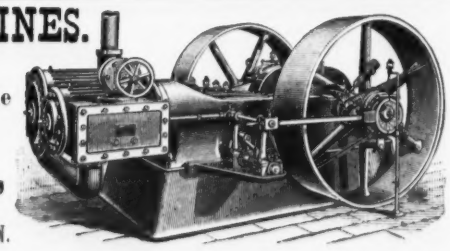

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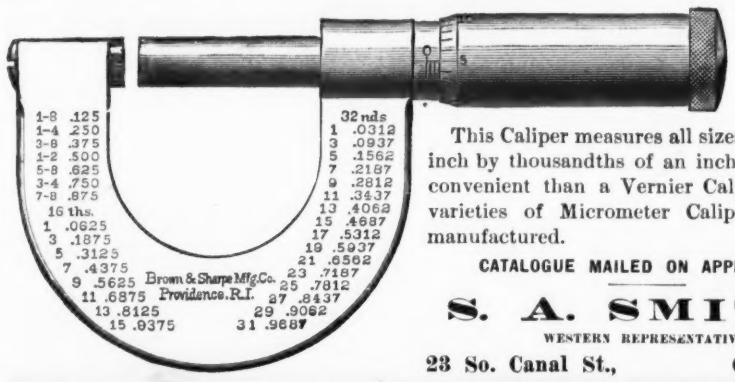

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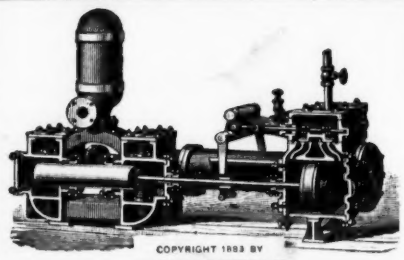

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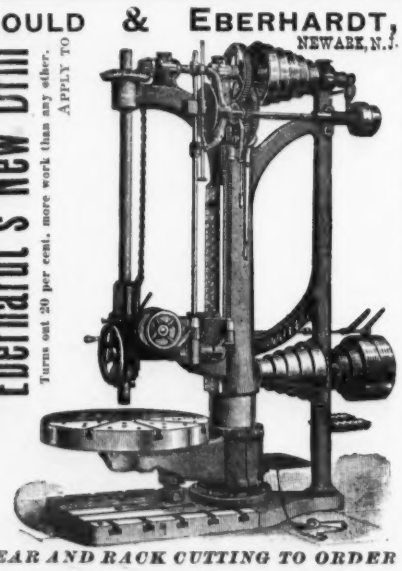

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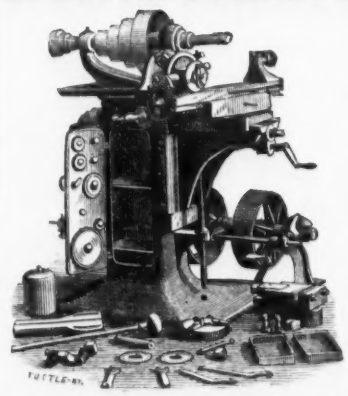

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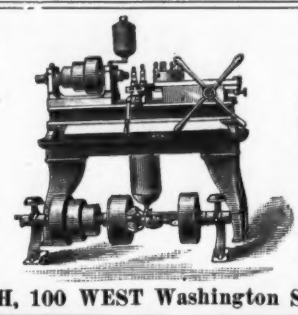

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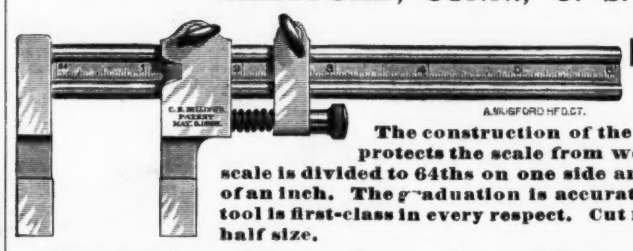

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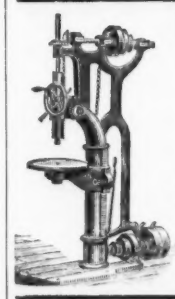

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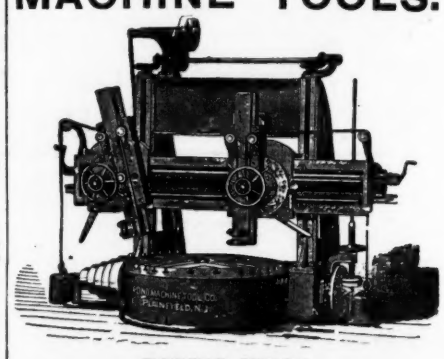

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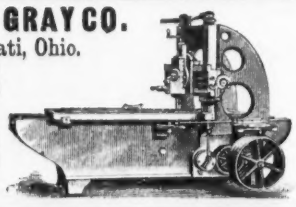

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